Mammals of the Eastern Rockies and Western Plains of Canada

BY

A. L. RAND

NATIONAL MUSEUM OF CANADA
OTTAWA

Figure 1. Head of Canada Lynx.

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[1] Photographs from the files of the National Museum.

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MAMMALS OF THE EASTERN ROCKIES AND WESTERN PLAINS OF CANADA

INTRODUCTION

The eastern slopes of the Rocky Mountains and the western plains that spread eastward from them are especially rich in mammals, large and small. In this area, the Dominion of Canada has established several National Parks on the eastern slopes of the Rocky Mountains—Jasper, Banff, and Waterton Lakes—for the preservation of wildlife, and these parks are popular resorts for visitors. On the plains in the south is Nemiskam National Park, established for the preservation of antelope; near Edmonton there is Elk Island National Park; and in the north is Wood Buffalo Park.

The importance of the mammals in these parks to the local residents and to visitors makes an inventory essential, and this volume was written to supply a guide to the mammals, their identification, and something about their way of life. The area outlined by these parks so nearly outlines the area of Alberta that the limits of that province were chosen as arbitrary geographical limits for the work.

Other mammals are our closest relatives (for we, too, are mammals) and we have a natural curiosity about our relatives. A knowledge of the wildlife of our forests and plains adds interest to and appreciation of our outdoors; its study has a recreational value, as well as a cultural value, and a knowledge of our wildlife and its relationships has a practical value. We must live with our neighbours; some must be controlled; some encouraged. Some have a value as objects of sport; some are a source of revenue as fur; and some devour what we want to eat. Conservation, the wise use of our resources, should be

based on knowledge. For practical reasons we must know more about our mammals, as well as for the reason that ignorance is dangerous.

Summaries such as this are built on the work of many individuals who have already laboured in the field, and this is no exception. A profound debt of gratitude is acknowledged to the many who have added to our knowledge. Richardson, and his Fauna is one of the landmarks in the mammals of Canada; Preble summarized the mammal data for northern Alberta in 1908; since then such workers as Hollister and Crowe have given us distributional lists of the Rocky Mountains, and Soper has given us accounts of various areas from the northern to the southern border. Many revisions of special groups have given details of distribution and variation. Anderson in his catalogue has summarized our knowledge of the distribution of mammals in this area.

Many students have given us details of the way of life of our mammals. Many of these were recorded outside our area, and though included, can only be tentatively accepted for the area until it is known that the details of behaviour, food, and breeding are actually the same.

In preparing this account, the works of others have been heavily drawn on, and the source and authority are given in most cases. Personal experience has been limited to one season's field work in the southern part of the province. Further acknowledgment must be made to R. M. Anderson, formerly Chief of Division of Biology, National Museum of Canada, whose experience and advice has been of inestimable value; to C. E. Johnson of the National Museum, who has prepared most of the drawings; and to R. W. Hawkins, of the National Museum, who prepared the map and did some of the diagrams.

AREA

Alberta extends from the Montana border of the United States (north latitude 49 degrees) north to the Northwest Territories (Mackenzie) (north latitude 60 degrees), a distance of 660 miles, and from the Saskatch-

ewan border on the east (west longitude 110 degrees) to the crest of the Rocky Mountains in the south and the parallel of 120 degrees west longitude in the north. Its area is about 255,285 square miles.

TOPOGRAPHY

Most of Alberta's surface is part of what topographers have called the "interior plain region of Canada." It is in general a rolling country with broad undulations and a slope eastward and northward of a few feet to the mile, descending from an elevation of 3,000 to 5,000 feet in the south and near the mountains in the west. In Wood Buffalo Park, in the extreme north, elevations vary from about 700 to 3,400 feet. In the southeast is a hilly mass, the Cypress Hills, rising to about 4,800 feet above sea-level, about 1,600 feet above the level of the surrounding plains; this is the central part of an elevated area separating Saskatchewan River and Missouri River drainage. The main irregularity in the topography of Alberta is the Rocky Mountains that rise sharply from the plains in the southern part of the western edge of the province, with thirty peaks between 11,000 and 12,500 feet above sea-level.

Three main river systems drain the province: Mackenzie River that flows to the Arctic Ocean, through its tributaries Peace and Athabaska Rivers; Saskatchewan River that flows into Hudson Bay, through its big branches the North and South Saskatchewan; and the Missouri that flows via the Mississippi to the Gulf of Mexico, sending one tributary, Milk River, into extreme southern Alberta.

The northern and central part of the province is well supplied with small lakes, with part of the large Lake Athabaska projecting into the northeast corner, and there are many lakes in the mountains of the west.

Geologically most of the province (the interior plain) is underlain by a series of nearly horizontal sedimentary rocks of Palæozoic, Mesozoic, and Tertiary age, with the Precambrian granite intruding only in the northeast corner. The Rocky Mountains consist of a series of great fault blocks in which an enormous thickness of Palæozoic and Mesozoic sediments is exposed.

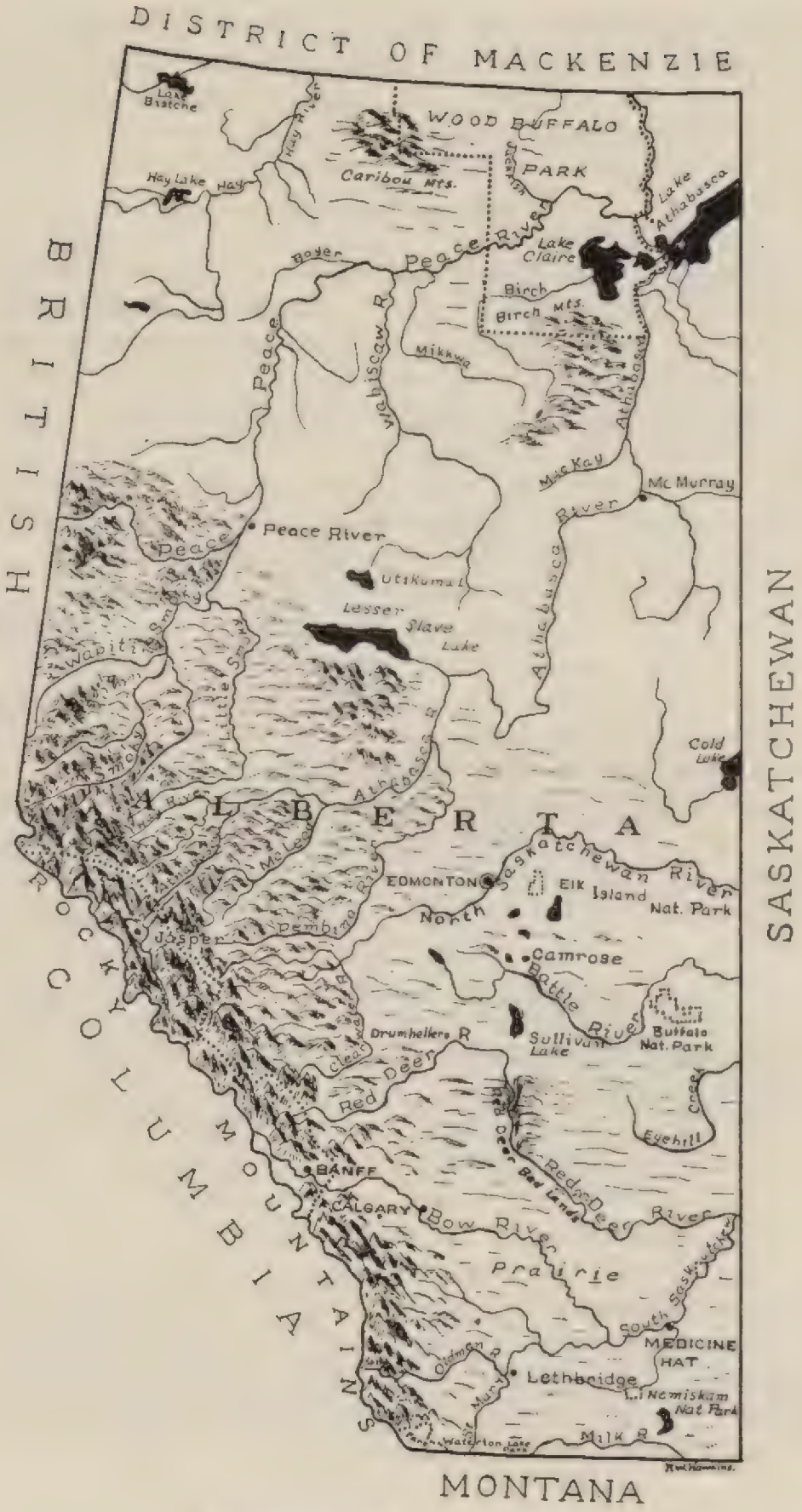

Figure 2. Map of Alberta.

During recent glacial periods most of Alberta east of the Rocky Mountains (the interior plain) was probably covered with ice; parts of the Rockies and probably the top of the Cypress Hills escaped glaciation.

References

Canada Year Book; and M. Y. Williams, 1929: Trans. Roy. Soc., Canada, 3rd ser., vol. 23, sec. 4, pp. 61-79.

CLIMATE

In Alberta the normal winter is cold, and in some years extreme cold persists from November to March, but in other years the chinook wind dominates the winter, warm days with bright sunshine frequently occurring.

In summer the isotherms run nearly north and south, so that the mean summer temperature is almost as high in the north as in the south. April average daily maxima are 53 degrees[1] at Calgary and Edmonton, and 58 degrees at Medicine Hat. The temperature curve rises rapidly in April, May, and June. Bright hot days are usual in July and August, temperatures occasionally exceeding 90 degrees, and 100 degrees may be surpassed in the southern districts; the average mean maxima are: Medicine Hat 82 degrees, Calgary 75 degrees, and Edmonton 74 degrees.

Though the Peace River country (at Dunvegan) and Lake Athabaska (at Fort Chipewyan) have about the same summer temperatures as Calgary and Edmonton, the temperature falls more quickly in the autumn, noticeable by late August.

The winter, from December to March, has average temperatures, distributed from north to south as follows: Calgary 18 degrees, Edmonton 14 degrees, Dunvegan 6 degrees, Chipewyan —3 degrees.

The chinook wind usually blows from the southwest or west. It occurs more frequently in the south, but is not uncommon as far north as the Peace River country. It can cause a rise in temperature from –20 to 40 degrees

[1] Temperatures are in degrees Fahrenheit.

in a few hours. This wind is the chief reason the ground is usually bare of snow over large areas of the prairies of southern Alberta during the winter.

In extreme south Alberta the average precipitation is less than 15 inches, and is between 10 and 12 inches in places; the central part of Alberta receives an average of 15 to 21 inches of rainfall, and this decreases northward to about 11 inches at the northern border. The heaviest rainfall is in the extreme southwest corner, where 21 to 31 inches are recorded. About one-half of the annual precipitation falls in June, July, and August.

References

Adapted from *Canada Year Book;* and Agriculture, Climate and Population of the Prairie Provinces, etc.; Dominion Bureau of Statistics, Ottawa.

Figure 3. The plains of southern Alberta, near MacLeod, with the snow-covered Rocky Mountains in the background.

VEGETATION

Extreme southern Alberta, east of the foothills and south of a line running northwest from just north of Calgary, is prairie, with trees only along the rivers (and one isolated forest on Cypress Hills); on the top of the Rocky Mountains are areas of Alpine grassland. The

Figure 4. The arid, short-grass prairie near Lost River in southeast Alberta. This is antelope range. Along the coulée in the mid foreground cottontail rabbits were common, and skunks and porcupines were found. The clump of trees is about the buildings of the Dominion Range Station.

Figure 5. The valley of Milk River, west of Wildhorse, in extreme southeast Alberta; in the background the Sweet Grass Hills in Montana show faintly.

northern part of the province, the mountain slopes, and foothills are largely covered with coniferous forests in which white spruce and jack pine are important components on the interior plains. The forests of the east slopes of the mountains are characterized by Engleman spruce, lodgepole pine, alpine fir (near timberline), white-barked pine, and, in the south, alpine (Lyall's) larch. Along the lower slopes in the southern part there is some Douglas fir.

Figure 6. The Rocky Mountains in western Alberta, near the head of North Saskatchewan River, on the Jasper-Banff Highway.

Though these forests are predominantly coniferous certain broad-leaf trees, notably aspen, balsam, poplar, black poplar, and white birch, occur, and in south-central Alberta, where the coniferous forests gradually give way to grassland, the poplars become the dominant trees.

In central and southern Alberta north to about Athabaska Landing, much agriculture has changed the vegetation cover, giving wheat fields and grassland mixed with poplar groves in areas that were originally forest.

References

Halliday, 1937: A Forest Classification for Canada; Dept. Mines and Resources, Forest Service Bull. 89.

Macoun and Malte, 1916: Flora of Canada; Dominion of Canada Year Book, 1922-23.

Figure 7. Forest, brush, and lake country in central Alberta near Belvedere.

Figure 8. Spruce forests, barren rocky ridges, and lakes of northern Alberta.

MAMMALS

DISTRIBUTION

The present paper lists 85 species and 133 kinds (species and subspecies) of mammals, belonging to 20 families, as occurring in Alberta.

Alberta Mammals
(Species included by groups)

—	No. of species	No. of kinds (species and subspecies)
Soricidae (shrews)	5	9
Vespertilionidae (bats)	8	11
Ursidae (bears)	2	2
Procyonidae (raccoon)	1	1
Mustelidae (weasels and their allies)	11	14
Canidae (wolves, foxes, etc.)	5	13
Felidae (cats, etc.)	3	3
Sciuridae (squirrels and their relatives)	12	20
Geomyidae (pocket gophers)	1	3
Heteromyidae (kangaroo rats and pocket mice)	1	1
Castoridae (beaver)	1	2
Cricetidae (mice, voles, and rats)	15	26
Muridae (house rats and mice)	2	2
Zapodidae (jumping mice)	2	3
Erethizontidae (porcupines)	1	3
Ochotonidae (pikas)	1	3
Leporidae (rabbits and hares)	3	6
Cervidae (deer, etc.)	7	7
Antilocapridae, (pronghorn antelope)	1	1
Bovidae (cattle, etc.)	3	3
Total	85	133

Some occur, or did occur, widespread over the province, such as the wolf (*Canis lupus*), and white-footed mouse (*Peromyscus maniculatus*). Others are obviously limited by their habitat requirements; red squirrels (*Tamiasciurus hudsonicus*) to trees; beaver (*Castor canadensis*) to waterways; mountain goats *(Oreamnos americanus)* to cliffs; and jack rabbits (*Lepus townsendi*) to plains. But there is an historical background that has had its effects in determining what mammals reached the province.

Figure 9. Map showing the present ranges of three species of Canadian mammals that have very different types of distribution; the moose, widespread in the coniferous forests; the antelope of the plains; and the goat of the mountains (after Anderson).

Some time before the last ice age mammals were probably distributed in a broad band across Canada. With glaciation most of the area now known as Alberta was ice covered, and unsuitable for mammal life. The mammal fauna retreated before the ice and survived in the forested areas in the east, in plains to the south, in forested and mountain areas to the west and southwest, and probably in the Alaska area.

With the retreat of the glaciers the area now known as Alberta was gradually populated from various directions.

The bulk of the forest fauna came from refuges in the east; part from the southwest, of which some is peculiar to the Rocky Mountains; from the plains to the south of the glacier came another element; and from the north came another small element.

The great bulk of the forested area is occupied by mammals, which presumably survived in eastern refuges and later pushed westward to occupy the broad transcontinental belt of coniferous forest. Typical of this assemblage are:

Cinereus shrew (*Sorex cinereus*)
Water shrew (*Sorex palustris*)
Saddle-backed shrew (*Sorex articus*)
Pigmy shrew (*Microsorex hoyi*)
Marten (*Martes americana*)
Fisher (*Martes pennanti*)
Least weasel (*Mustela rixosa*)
Wolverine (*Gulo luscus*)
Lynx (*Lynx canadensis*)
Woodchuck (*Marmota monax*)
Northern flying squirrel (*Glaucomys sabrinus*)
Beaver (*Castor canadensis*)
Bog lemming (*Synaptomys borealis*)
Phenacomys vole (*Phenacomys intermedius*)
Red-backed mouse (*Clethrionomys gapperi*)
Varying hare (*Lepus americanus*)
Moose (*Alces americanus*)

During isolation by glaciation certain forms developed in the west or southwest, and with the retreat of the glaciers these spread into the area. Many of the forms indicating this isolation are of only subspecies status, but the distribution of a few species indicates they follow this pattern.

The dusky shrew (*Sorex obscurus*) is such a western form, with an isolated population left on the Cypress Hills and a few populations farther east. Others are:

Long-tailed meadow vole (*Microtus longicaudus*)
Western jumping mouse (*Zapus princeps*)
Mountain caribou (*Rangifer montana*)

There is a considerable western mountain element that is adapted to the mountains, and an ecological factor, as well as an historical background, explains their restriction, or near restriction, to the mountains.

Hoary marmot (*Marmota caligata*)
Columbian ground squirrel (*Citellus columbianus*)
Mantled ground squirrel (*Citellus lateralis*)
Allen chipmunk (*Eutamias amoenus*)
Rufous-tailed chipmunk (*Eutamias ruficaudus*)
Wood rat (*Neotoma cinerea*)
Richardson vole (*Microtus richardsoni*)
Pika (*Ochotona princeps*)
Mountain sheep (*Ovis canadensis*)
Mountain goat (*Oreamnos americanus*)

A considerable number of larger mammals that are now thought of as western, but that formerly spread much farther east, and whose range was driven westward by the encroachment of civilization are:

Cougar (*Felis concolor*)
Grizzly bear (*Ursus horribilis*)
Elk (*Cervus canadensis*)
Bison or buffalo (*Bison bison*)

Others, mainly western, still extend far east, such as:

Coyote (*Canis latrans*)
Least chipmunk (*Eutamias minimus*)
Black-tailed deer (*Odocoileus hemionus*)

The Arctic area also has had an influence on the Alberta fauna. Certain species that probably had their origin in the northwest have spread into the northern or western part of the province, such as:

Brown lemming (*Lemmus trimucronatus*)
Chestnut-cheeked vole (*Microtus xanthognathus*)

From the barren grounds of the north migrants of two species come south in winter to extreme northern Alberta:

Barren-ground caribou (*Rangifer arcticus*)
Arctic fox (*Alopex lagopus*)

Figure 10. Life zones of Canada (from Anderson 1938).

On the plains of the southern part of the province, and extending in some cases into the forest belt, often with peculiarities of local distribution, are found such plains species as:

Black-footed ferret (*Mustela nigripes*)
Badger (*Taxidea taxus*)
Kit fox (*Vulpes velox*)
Franklin ground squirrel (*Citellus franklini*)
Richardson ground squirrel (*Citellus richardsoni*)
Thirteen-lined ground squirrel (*Citellus tridecemlineatus*)
Gopher (local) (*Thomomys talpoides*)
Kangaroo rat (*Dipodomys ordii*)
Grasshopper mouse (*Onocomys leucogaster*)
Lesser meadow mouse (*Pedomys minor*)
Pallid vole (*Lemmiscus curtatus*)
White-tailed jack rabbit (*Lepus townsendi*)
Cottontail (local) (*Sylvilagus nuttallii*)
Pronghorn antelope (*Antilocapra americana*)

The correlation of the distribution of Canadian Alberta mammals with Merriam's life zone concepts has been summarized by Anderson. As his summary affects Alberta, he includes the alpine grassland in the Hudsonian zone; the forested country in the Canadian zone, and the plains in the Transition zone.

Although some mammals range commonly through more than one zone, as has been indicated previously, others are more restricted, and indeed restricted to only part of a zone, either due to habitat requirements or because of historical reasons.

The Hudsonian zone in Alberta is poorly characterized by mammals. The following are the most nearly restricted to this zone.

Mountain caribou (*Rangifer montana*)
Richardson vole (*Microtus richardsonii*)

The Canadian zone, which includes all the main forested areas, is characterized by a comparatively long list of species in Alberta, such as:

Cinereus shrew (*Sorex cinereus*)
Water shrew (*Sorex palustris*)
Marten (*Martes americana*)
Fisher (*Martes pennanti*)
Lynx (*Lynx canadensis*)
Northern flying squirrel (*Glaucomys sabrinus*)

Red-backed mouse (*Clethrionomys gapperi*)
Snowshoe rabbit (*Lepus americanus*)
Moose (*Alces americana*)

The Transition zone in Alberta is generally characterized (now or formerly) by the presence of:

Richardson ground squirrel (*Citellus richardsoni*)
Badger (*Taxidea taxus*)
Kit fox (*Vulpes velox*)
Jack rabbit (*Lepus townsendi*)
Pronghorn antelope (*Antilocapra americana*)

HABITATS

Mammals within their range have special preferences as to the habitats in which they live. This often correlates with manner of feeding and structure. The pocket gopher (a fossorial type) with its strong forelegs and elongated claws for digging spends most of its time underground in tunnels it makes; ground squirrels, woodchucks, and many mice spend most of their active time on the surface of the ground, but with underground dens to retire in for safety and sleep; muskrats and beaver (amphibious type), adapted for swimming, find their favourite habitat in the water, coming ashore for food; some mammals spend all their time on the surface of the ground (terrestrial), like the deer and the antelope; some climb into the trees overhead, as white-footed mice, flying squirrels, and marten (arboreal); and bats feed in the air (aerial).

Although the habitat of some mammals includes a wide variety of conditions, as the coyote, a running plains animal, which also ranges in the forest, and the porcupine, a tree-climbing animal that ranges through the forests and far out into the plains, and the beaver and muskrat that live in waterways under a great variety of conditions, many mammals are more selective. Red-backed mice and cinereus and dusky shrews are largely restricted to damper forests; short-tailed meadow mice to denser, damper, grassy areas and glades, in plains or forests; and lesser meadow mice favour drier grassland, the pallid vole even goes into the sage bush flats; water shrews are restricted to the edges of waterways in or near the forests; Richardson vole to alpine streams; pocket gophers are locally dis-

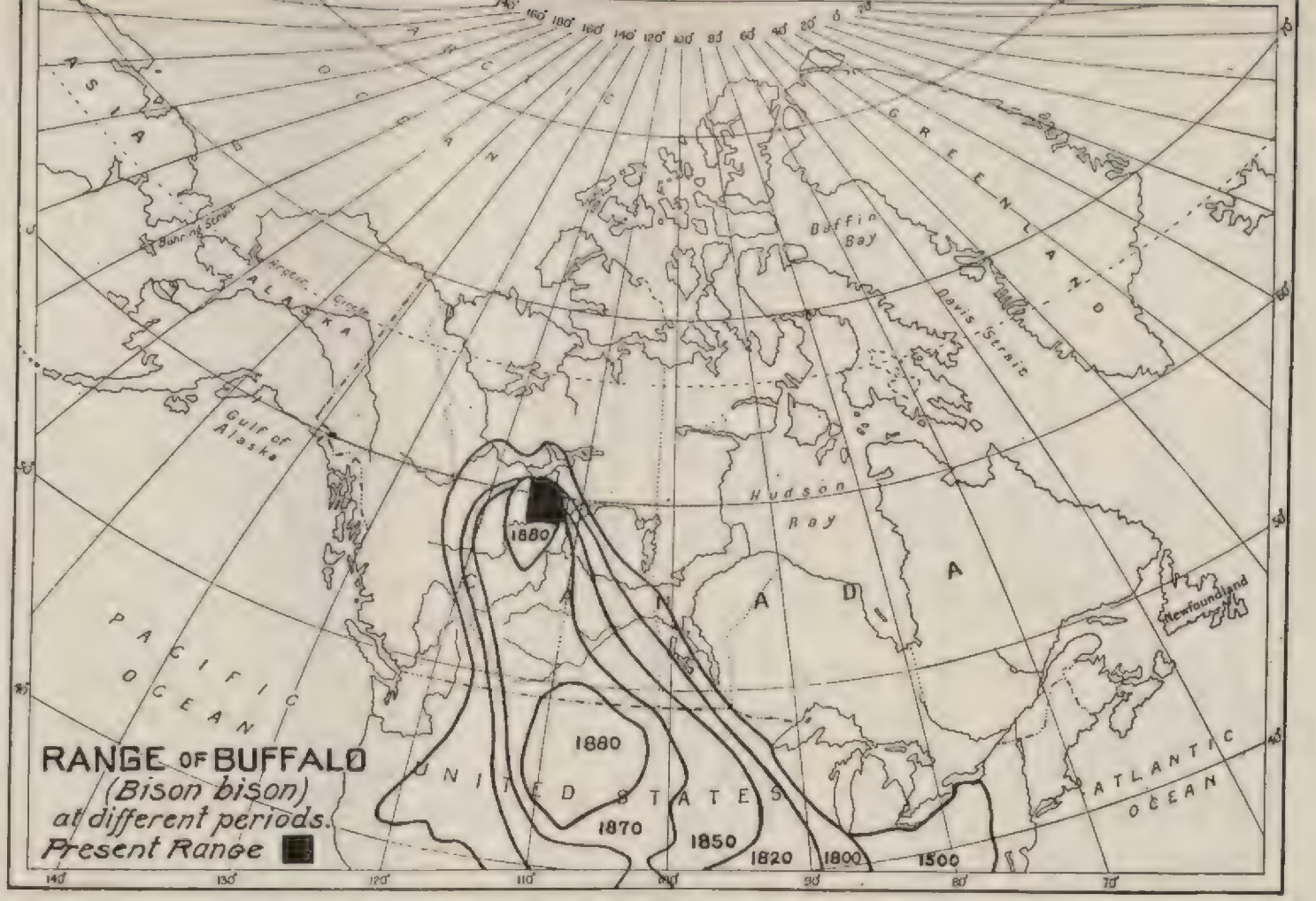

Figure 11. Map showing the progressive reduction of the range of the bison, which was the direct result of human activities (after Anderson 1938).

tributed in open country where soil is suitable for burrowing; pikas and wood rats as well as mantled ground squirrels need the shelter of rocks for their existence; mountain goats need the vicinity of cliffs to which to retreat for safety; and pronghorn antelope, depending on speed for safety, live on the open plains.

In any one area, a close study of the mammals will show that rarely do two species living in that area have the same habitat requirements. There are a few apparent exceptions; the two shrews (cinereus and dusky), the two meadow voles (the long-tailed and the short-tailed), and the two deer (white-tailed and black-tailed), and the ground squirrels in some areas. A study of their relationships where this occurs would repay effort.

CHANGES IN MAMMAL LIFE

In the middle part of the last century great herds of buffalo roamed the plains, and northern forests; herds that have disappeared except for those in parks. Antelope nearly disappeared about the beginning of the century, but have now increased in numbers; elk have disappeared over much of their original range, though still common in the mountains. Some of the most important fur bearers, the beaver, marten, and fisher, whose pelts used to bulk large in the fur trade, have been over trapped until cheap furs have taken their place. Wolves have completely disappeared from the southern plains, and the kit fox is almost gone.

Though we regret the necessity, some of these changes were necessary. Buffalo herds and wheat fields, wolves and cattle, just couldn't get along together; but in Alberta most mammals are still well represented, and there is space for them. The fisher, lynx, and kit fox are still in a precarious situation, however, the first two being on the verge of commercial extinction, and the latter nearly extirpated. The Government of Alberta, with its wise game laws, preserved areas, and supervisions, and the Dominion Government with its national parks ensure that we will always have enough of most mammals in the province. The national parks, that are havens for wildlife, and attractive because of the abundance of big mammals that may be seen, are as follows.

National Parks in Alberta

The following data are largely from the *Canada Year Book*, 1945, pp. 30-33.

Banff, in western Alberta on the east slope of the Rockies, established in 1885; area, 2,585 square miles; a typical example of the central Rockies with massive ranges, ice-fields, alpine valleys, glacier-fed lakes, and hot mineral springs.

Waterton Lakes, in extreme southwestern Alberta, adjoining Glacier Park in Montana, U.S.A.; established in 1895; area, 220 square miles.

Jasper, in western Alberta on the east slope of the Rockies, established in 1907; area, 4,200 square miles; immense region of majestic peaks, deep canyons, and beautiful lakes.

Buffalo National Park, in eastern Alberta near Wainwright, established in 1908; area, 197·50 square miles; fenced area originally set aside for the preservation of buffalo and other big game. Animal population since withdrawn and area utilized by the Department of National Defence for war purposes.

Elk Island National Park, in central Alberta, near Lamont; established in 1913 (reserved in 1906); area, 51·20 square miles; fenced preserve containing a large herd of plains buffalo; also numerous deer, elk, and moose.

Nemiskam National Park, in southern Alberta, near Foremost; established in 1922; area, 8·50 square miles; a fenced preserve established to protect pronghorn antelope.

Wood Buffalo National Park, partly in Alberta, 13,675 square miles, and partly in Northwest Territories, 3,625 square miles; established in 1922; area, 17,300 square miles approximately; immense unfenced areas of forests and open plains dotted with lakes and with numerous streams and rivers. Contains a large herd of buffalo, developed from the native "woodland" type, and surplus plains buffalo from Buffalo National Park; also bear, beaver, caribou, deer, moose, and waterfowl; area as yet undeveloped. There is a good faunal account of this park, *See* Soper, 1942, Mammals of Wood Buffalo Park, etc.; Jour. Mammal., vol. 23, pp. 119-145.

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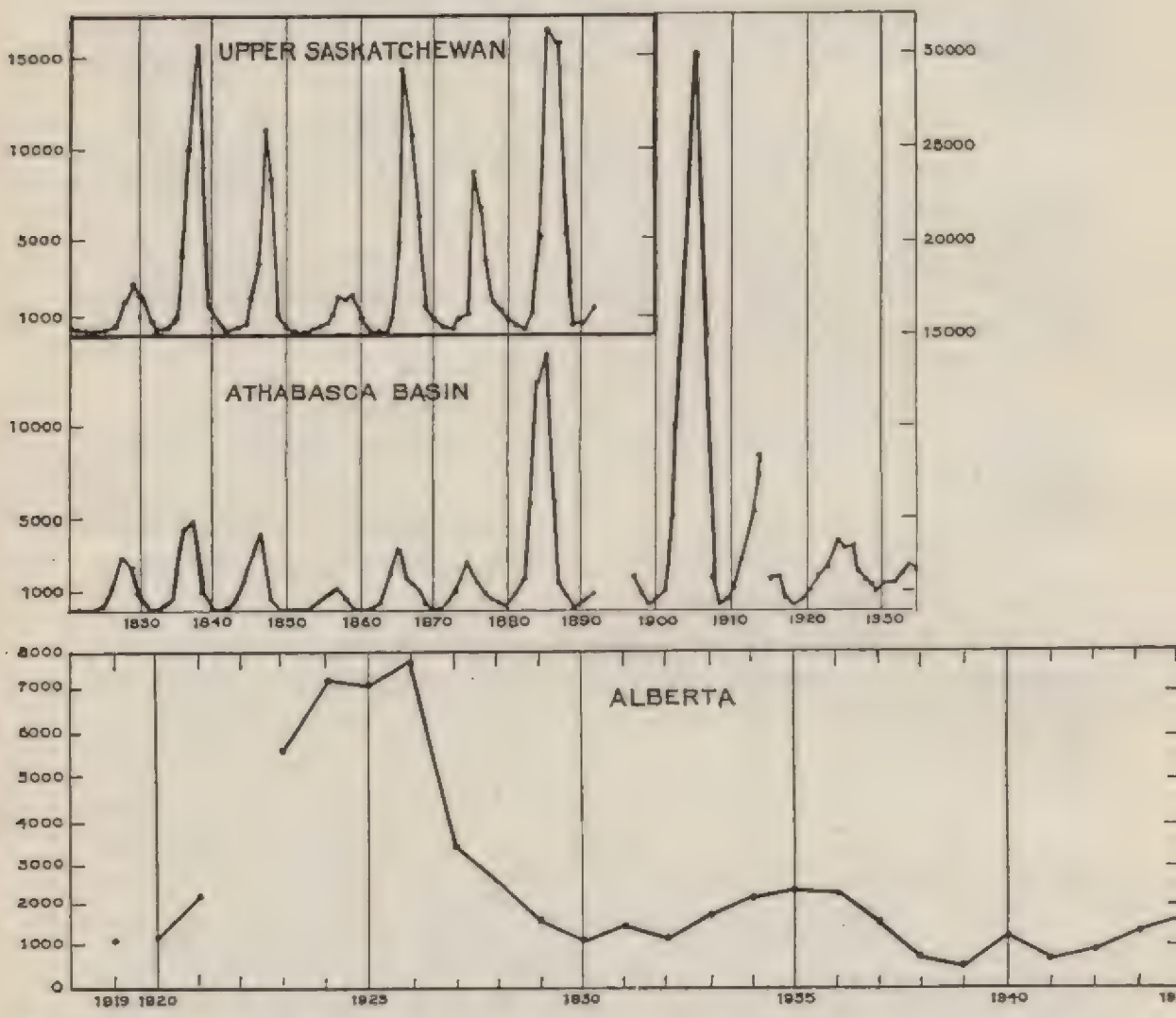

Figure 12. Chart showing the lynx take in Canada; illustrating the amazing regularities of the lynx cycles in Canada (a and b from Elton, and c showing the lynx take in Alberta, 1919-20 to 1943-44). Though the recent lynx take is very low, it still tends to fluctuate over a cycle of about 10 years.

CYCLIC CHANGES

All the changes in mammal populations from year to year are not the results of human activities. Best known of these perhaps are the cyclic changes in the snowshoe rabbit and the correlated cycle of the lynx.

Thanks to the early work of Seton and Hewitt, and the later surveys of Elton and his co-workers at the Bureau of Animal Population, Oxford, and the National Parks Bureau, Ottawa, we know that snowshoe rabbits tend to fluctuate regularly with a period of about 10 years between the population peaks, when they are most abundant. The lynx, which depends largely on the snowshoe rabbit for food, used to have similar fluctuations, but in recent years its numbers have been so reduced that the fluctuations are less evident.

Many other mammals also fluctuate in numbers, as the fisher, marten, fox, and muskrat, with a regularity that indicates a cycle of about 10 years, but there is some evidence that these are local affairs rather than with widespread correlation. Cross, in Ontario, writing of the red fox, is strongly of the opinion that these fluctuations are local; and Elton, for the muskrat, shows that in the north and the south of western Canada there have been periods when abundance did not coincide.

Smaller mammals also have their fluctuations. There is little Alberta data, but from extralimital information we can predict that the small rodents such as the meadow mouse will be found to fluctuate on a 4-year cycle; and shrews may do the same; squirrels may be found to fluctuate on a cycle of about 7 years. Wolves also fluctuate over long periods.

In a few cases, as the lynx cycle following that of its food species, the snowshoe rabbit, there seems to be a direct cause and effect.

But the fundamental causes of these cyclic changes in abundance is obscure; Elton suggests an external controlling climatic factor; there is also the theory of a prey-predator relationship that must be considered. When the prey species is abundant the predators increase until they cause a decline in the prey species, and later, with less abundant food, the predators decline in numbers, allowing the prey species to increase. Then must be considered the theory that populations build up to a critical level, after which they decline suddenly, due to population factors, such as exhaustion of food and abnormal opportunities for the spread of epidemics when the critical level is reached.

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Voles, Mice, and Lemmings, by Charles Elton, Oxford, 1942, and the very important review of this volume by G. Evelyn Hutchinson in the Quarterly Review of Biology for December 1942.

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SEASON BY SEASON

With the great change from summer to winter in Alberta, mammals must meet drastically changed conditions. With some, like the marten, it is little more than a completion of the moult and a resultant thicker coat; but with others there are additional adaptations. Some of the bats, like the hoary and red bats, flee the country, migrating to warmer climates for the winter and returning in the

Figure 13. The weasel changes its coat with the season to match its background; in summer the pelage is brown (left) and in winter the weasel moults into a white pelage (right).

spring. Many other mammals make seasonal movements of lesser extent, movements that are so short they have hardly merited the term migration, though that is what they are. In the extreme north, barren-ground caribou come into the province, migrating from the north, to spend the winter; some of the hoofed animals, the black-tailed deer, elk, and sheep that spend the summer solitary or in small bands at high altitudes in the mountains, come to our lower altitudes and gather into larger bands in the autumn; the

pronghorn antelope gathers from its scattered range into smaller favoured areas, some in the Wildhorse area, others in the Suffield area.

Other species that stay in the same locality for the winter meet it in different ways; the marmots, woodchucks, ground squirrels, jumping mice, bears, and some bats go into the profound winter sleep of hibernation. Some store food, like the pikas with their haystacks, and the chipmunks, which are little active during the winter, with their stores of seeds. The red squirrel, too, though active during the winter except in most severe weather, also stores cones and berries. Some carnivores, like the mink, also make caches of food.

The snowshoe rabbit, which is exposed to predators all winter, moults into a white coat in the autumn, and in the spring moults back into a brown coat, harmonizing with the snow in winter and the snowless landscape in summer, though there may be short periods spring and autumn when it is conspicuous, as when it turns white before the snowfall. Not only do prey species turn white in winter, for all three of the carnivorous weasels also moult into a white winter coat and again moult into a brown summer one.

The food of many species changes; the porcupine feeds on much herbaceous material in the summer, and in winter must rely on bark of trees; the forest and bushland rabbits that feed on succulent herbs and grasses in the summer must turn to twigs and bark and leaves of conifers in winter. The foxes that eat many insects in the summer must turn more to a mammal diet in winter; when the snow covers the land so that meadow mice are hidden, it must turn to rabbits or other food. Probably most species make drastic changes in their lives to meet winter.

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Lives of Game Animals; Doubleday, Page and Co., vols. 1-4, 1925-1928 (and later editions).

What mammals eat is correlated with where they live, and with their equipment for getting food, and probably with an inherited taste for certain items. From an examination of the teeth of an animal one could make a reasonable deduction as to its general food; the sharp, pointed teeth of shrews and bats for insect eating; the fangs of carnivores

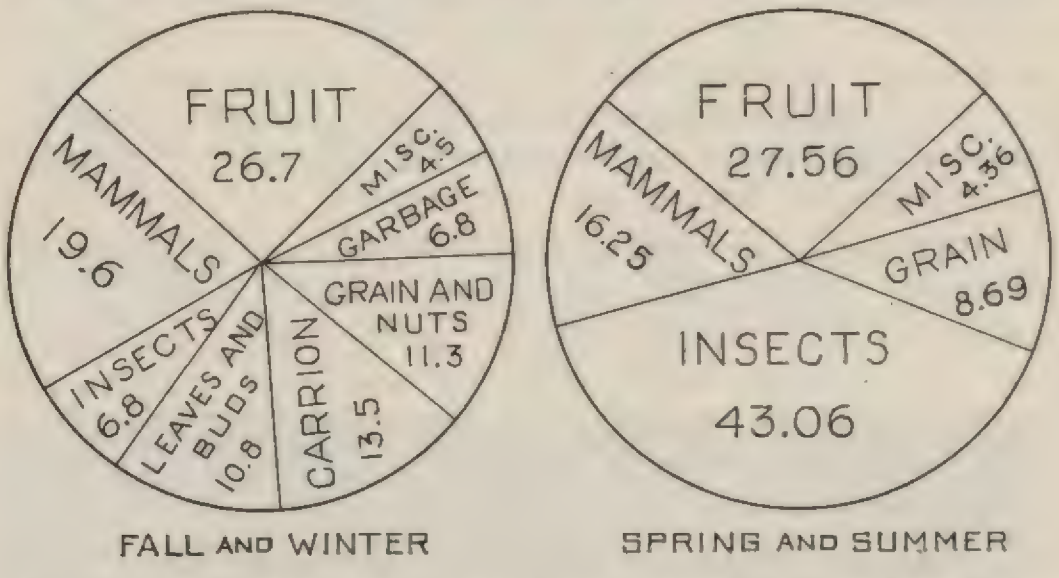

Figure 14. Diagram showing food of skunk; in summer when insects are important, and in winter when insects are less important, in its diet. Figures indicate percentages of each item (New York data from Hamilton).

for flesh eating; the gnawing teeth of rodents for cutting vegetation, and their grinding cheek teeth for chewing it; the lack of upper incisors in hoofed mammals (ungulates) and their grinding cheek teeth for browsing and grazing.

Most shrews run about on the ground to get their insect and other small animal food; the water shrew hunts in the water; bats fly about in the air overhead and take their insect food on the wing. Shrews also eat seeds, and Criddle suggests that in winter seeds may be an important food. The bears and raccoons, though carnivores, have a generalized diet and eat much vegetable food. It has been said of the bears that although they have a taste for flesh, they are unable to catch enough to feed themselves, and so eat carrion, what few mammals

they can catch, and vegetation as a second choice. This generalized diet is reflected in the character of their cheek teeth, which are broad on top, for crushing their food, rather than more sharp edged for cutting flesh. The weasels and their relatives, like the marten and fisher, mainly dependent on other mammals for food, hunt with agility on the ground or in trees or follow their prey into burrows. But the mink has adapted a semi-aquatic habit, and the otter still more has become largely a fish eater. The skunk eats many insects, and the badger digs out ground squirrels.

The wolves, coyotes, and foxes, which are adapted for running, run down some of their prey, but sometimes, as coyotes and foxes do, hunt mice by stealth and pouncing. The cats, such as the wildcats, habitually hunt by stealth, creeping on their prey, or waiting for it to appear, and pouncing on it.

The gnawing animals, rodents and rabbits, eat grass, fruits, seeds, leaves, twigs, and bark. Some, such as the chipmunk, specialize in seeds; others, such as the meadow mouse, specialize in herbaceous material; the snowshoe rabbit feeds extensively on the leaves of conifers; the porcupine, at times at least, depends largely on the bark of trees. No one would guess from the structure of beaver that it cuts down big trees to get the twigs and small branches for food. Though the gnawing animals depend largely on food of vegetable origin, many of them have a taste for animal food. Many of the mice relish insects, and one of them, the grasshopper mouse, depends largely on animal food. Many of these gnawing animals eat the flesh of other mammals when it is available; red squirrels and flying squirrels come readily to meat bait in traps; rabbits come on to roads to nibble at the flesh of other rabbits that have been run over by motor traffic; and many of the mice will devour other flesh, as the small mammal trapper discovers when he finds his catch partly eaten in his traps.

The hoofed animals have two main types of feeding; by grazing on herbaceous plants, as do the antelope and sheep; and by browsing, as do goats and moose. The herbage is taken into the mouth, and broken off against the lower teeth by an upward movement of the head. The

moose has a modification of the grazing habit, wading deep into the water and submerging its head to get aquatic plants.

Some mammals depend on plants for their food; others depend on other animals that in turn depend on plants. Sometimes plant eaters increase so that they threaten to destroy their food; sometimes the meat eaters become abundant. There was never a balance, but rather a slow pendulum swing oscillations. With the advent of men, and the supplying of inviting food supplies, as wheat for ground squirrels, cattle for wolves, and turkeys for coyotes, additional complications were added; and with settlement, and man's hunting pressure, the original conditions were still further upset.

Food habits of mammals must be taken into account in conservation measures, and as they may vary from locality to locality local studies are necessary. Few are available for Alberta. The results of careful studies are sometimes surprisingly at variance with local opinion, as Criddle's studies on weasels in Manitoba. Weasels have a notorious reputation as robbers of hen houses, and yet Criddle's studies showed they killed few fowls, but did good service by killing rats and other rodents.

References

See under preceding section.

REPRODUCTION

The mating season of the elk starts in the autumn with the first frosts, when the bull elk come down from the mountains to gather their harems and carry on their polygamous mating. There is bugling of challenges, and fights over harems.

Many of our mammals are probably polygamous or promiscuous in their mating, and the males have no part in the family life, though the details of mating are little known in the smaller forms. There are some exceptions, notably with the wolves, where mating is monogamous, and in which the male takes part in the care of the young, bringing food to the den.

Figure 15. The young of the meadow mouse are naked, blind, and helpless at birth, and are concealed in a nest. In this picture of an exhibit in the National Museum, the nest has been opened.

Figure 16. The young of the snowshoe rabbit are fully furred at birth and soon to hop about (group, National Museum).

The young tend to be born when conditions are most favourable for it, in the spring or summer, but young bears are born in midwinter while the female is in hibernation. The gestation period varies greatly; from about 3 weeks in some mice to nearly a year in the fisher. Mating of the marten, fisher, and weasels occurs in the spring or summer of one season for the young to be born in the next. Many of the hoofed animals usually mate in the autumn, with young born in the spring; many animals breed very early in the spring, and have the young born in late spring, as the woodchuck.

Larger mammals, with long gestation periods, have only one litter a year, as hoofed animals, marten, weasels, and woodchucks. Bears usually have young only once every 2 years. Some of the smaller mammals, with short gestation periods, have several litters a year in quick succession, like meadow mice and red-backed mice. Sometimes in the early autumn it is possible to separate samples of populations into several age groups, corresponding to various litters born during the year.

The number of young born varies from one in some forms, as the buffalo, to ten or so in such forms as coyotes, shrews, and some mice.

The young differ widely in their state of development at birth; the hoofed animals generally have well-developed young, fully furred, open eyed, and able to follow their parents shortly after birth. The young of snowshoe and jack rabbits and porcupines are also of this type. The young of many mammals are born in a very undeveloped state, naked, eyes closed, and unable to do much more than suckle (as with mice, bears, and cottontail rabbits).

The provisions made for the young are correlated with their conditions at birth. The hoofed animals and the snowshoe rabbits make no nest; some mice make oval nests of dead grass, underground or under some shelter; wolves and foxes dig burrows for nurseries; and woodchucks use their dens.

All our young mammals are dependent on their mothers for milk and nourishment in the early days of their lives. This quickly changes to eating vegetation in some species, like porcupines and hares; much longer in some such as deer; the young get their first food for themselves while venturing about, nibbling vegetation; the carnivores have food brought to them by the parent. With most of our mammals it is only the female that cares for the young, but in some, as the fox, the male helps care for the young and brings food.

In many species the family groups break up by autumn, but in a few, as in the bears, the young accompany the mother for a year or more.

References

See under preceding section.

Figure 17. Pack-trains such as these carry the sportsman into remote areas in search of big game.

IMPORTANCE TO MAN

The mammals of Alberta have various and complex relationships to the residents of the province.

The fur-bearers yield a substantial income to the province; meat-producing animals provide food for many wilderness dwellers, and others; beaver, by helping con-

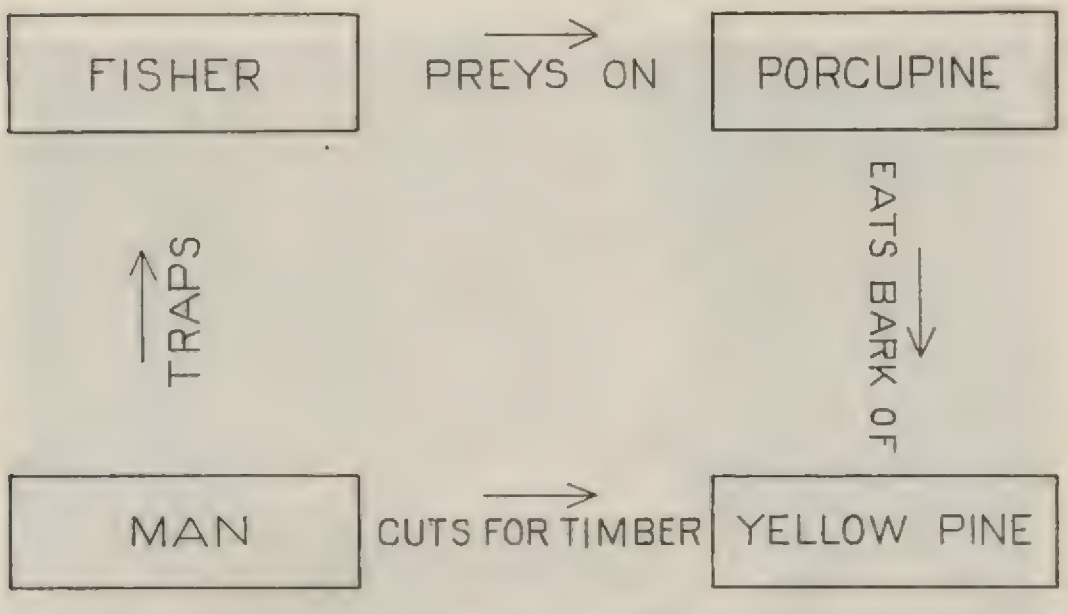

Figure 18. Diagram of some indirect ecological relationships between the fisher and the yellow pine (from Hall 1942). Porcupines are accused of eating yellow pine. Man by trapping fisher removes one of the natural checks on porcupines.

serve water, are at times an aid to man's activities; the big game furnishes hunting and thus recreation for a part of the people. The presence of mammals adds interest to living in the country, and the large mammals particularly are an attraction to visitors, both in sightseeing and in hunting, whose value is hard to assess. Some mammals benefit us by eating insect pests.

The mammal population also causes damage. Bears and coyotes (and formerly wolves) destroy stock; wolves and cougars kill big game; smaller predators kill small game; mink and otter take game fish; deer and elk eat stacked hay; rabbits, deer, ground squirrels, and pocket gophers eat garden stuff, and ground squirrels (gophers of the ranchers) must be controlled on grain fields; bears damage cabins and wood rats may so befoul them as to

make them hardly habitable; mice may eat into foodstuffs in larders; beavers may flood roads, and on the plains may eat cherished trees; muskrats may injure earth dams and irrigation ditches; porcupines may eat up saddlery and cause annoyance by gnawing camp buildings and equipment. Some animals may carry diseases that are transmittable to humans.

Figure 19. Trappers who spend the winter gathering pelts in the forest make their headquarters in such cabins as this.

And beneath all this is a web of interdependence that makes it inadvisable to advocate the complete extermination of any species, even if we could.

The mice and the rabbits are the first stage in turning vegetation into flesh for the use of the carnivores, some of which are valuable fur bearers; the destruction of carnivores might result in the great increase of grass eaters; a too great decrease in some of the small rodents might result in the increase of some insect pests.

Larger carnivores have few friends, but there is the classical argument that by preying on the weak and the

unfit they have benefited the prey species by improving the quality of the stock. Lower mammal predation on game must be balanced against human predation on game. Without either, a game species might increase until it was so plentiful it would eat all available food, and then with the range ruined, it could support few game animals, the rest dying of starvation.

Reference

Economic Mammalogy by Henderson and Craig; Charles C. Thomas, 1932.

FUR

The fur trade is such an important item that it is advisable to tabulate separately its data.

The returns of the fur bearers of Alberta as given by the province of Alberta annual report for the year ended March 31, 1944, are:

Alberta Fur Production

(Season July 1, 1943 to June 30, 1944)

Kind	Total number of pelts	Average value per pelt	Total value of pelts
Badger	4,031	$ 3.42	$ 13,786.02
Bear	121	4.00	484.00
Beaver	5,968	34.61	206,552.48
Ermine	180,473	2.37	427,721.01
Fox (other than red)	27,888	20.00	557,760.00
Fox (red)	31,645	14.62	462,649.90
Lynx	1,474	49 09	72,358.66
Marten	685	55.06	37,716.10
Mink	65,198	20.98	1,367,854.04
Muskrat	223,661	2.12	474,161.32
Otter	105	28.26	2,967.30
Rabbit	225,213	0.08	18,017.04
Skunk	28,460	3.94	112,132.40
Squirrel	687,039	0.60	412,223.40
Wolf (coyote)	31,028	16.36	507,618.08
Wolf (timber)	732	15.06	11,023.92
Wolverine	26	15.00	390.00
Fitch	155	1.50	232.50
Fisher	15	55.83	837.45
Wildcat	10	2.00	20.00
	1,513,927	.....	4,686,505.62

Figure 20. Some of the mammal specimen cases in the National Museum, showing how the skins and skulls (in the boxes of the partly opened tray to the left) are filed for convenient reference.

For a discussion of the fur trade in Canada *See* "The Fur Trade in Canada" by H. A. Innis, 1930; and for yearly take *See* mimeographed releases from the Dominion Bureau of Statistics, Ottawa.

MAMMAL STUDY

The first step in mammal study is recognizing the different kinds of mammals, and this is one of the main objects of this volume. Usually there is little doubt as to what group an animal belongs; whether it is a bear, fox, or deer. But there is the possibility of confusing a shrew with a mouse. On page 40 is given a synopsis of the orders of mammals, with reference to the families into which the orders are divided, and where keys to the species may be found.

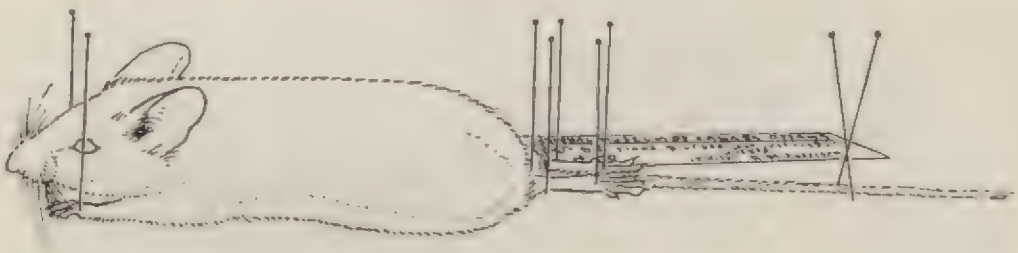

Figure 21. A white-footed mouse skin pinned out to dry.

Colour and external characters will serve to identify many of the larger, and the diurnal mammals. But the casual observer will see few of the many small mammals in an area, and the brief glimpse he may catch will not serve for identification.

For knowledge of the small mammals of an area, trapping must be resorted to. If one is interested in catching the animals alive, and keeping them in clean, comfortable quarters, box traps may be used.

For identifications, spring mouse traps may be used, and the specimens, skins and skulls (for the skull is often more important than the skin in identifying small mammals), preserved. The National Museum has a pamphlet "Instructions for Preserving Animal Specimens for Scientific Purposes," by R. M. Anderson, giving instructions on preparing specimens.

Much has been recorded of the distribution and way of life of most of our animals, but much remains to be learned.

A student may want to make a complete list of the kinds of mammals in his area, their abundance, habitat, food, and seasonal changes, in which case he should gather information from the knowledgeable inhabitants (who often have important data on changes of abundance), and from hunters and trappers (who often have an enormous store of data on certain groups, especially the larger animals), and make collections himself, especially of smaller mammals. The following notes under each species give an indication of where the different mammals may be expected to occur, but experience and searching will be necessary before the tyro becomes an adept.

Figure 22. A Museum special mouse trap set at the end of a hollow log, so that any small mammal entering or leaving the log will be caught even though not interested in the bait.

The trapped specimens will yield much data, besides the identifications from the skin and skull; by noting the kind of place where they were taken, habitat is learned; by

keeping track of the number of traps set, and the number of individuals taken, an index of abundance is obtained from comparison with other localities and other years. A convenient index is the number of individuals taken per 100 trap nights, a trap night being one trap set one night (1 trap set for 100 nights, or 100 traps set for 1 night, or 50 traps for 2 nights equals 100 trap nights). Examination of the pelage gives data on moult and external parasites; of cheek pouches and alimentary tract, data on food and internal parasites; examination of the reproductive tract of females gives data on the time of breeding and the number of young.

On diurnal animals, and on animals in captivity, observations can be made that will add much to our knowledge.

"In a field like this no one can cover every detail, and the notes of many persons are needed for working out complete life histories of any species, even the commonest. A young observer may find out something that was not known before and in classic phrase 'add something to the sum total of human knowledge'" (Anderson).

An outline as a guide is important to indicate points to be looked for. The following is adapted from Dr. Anderson's article on mammal study in the Canadian Field-Naturalist, 1919, vol. 33, pp. 86-90; as a preliminary guide:

Present and former status: including estimates and counts of numbers of mammals; fluctuations in numbers from year to year, and causes.

Means of detecting presence: including tracks, fæces; claw marks on trees; tooth marks on bones; wallows; nests; cuttings.

Habitat relations: including preference for soil, water, vegetation of different kinds.

Interrelationship of species: including friends, enemies, offense, or escape; competition between closely related species.

Times of daily activity: including time of starting and ending activities, relation of this to weather.

Migration and hibernation: including dates of appearance and disappearance and relation of this to weather, direction of migration, and place of hibernation.

Movements: including mode of travel, speed, and endurance.

Voice and other means of intercommunication: including calls, their description and meaning, visual signals, odour.

Social organization: including formation of bands and colonies, their permanency, or the antagonism of one individual to another of the same species.

Feeding and drinking: including list of foods and relative importance of each, seasonal variation in this, adaptations for special food getting, manner of eating, and storing food, need of water and frequency of drinking, manner of drinking.

Individual characteristics: including temperament, intelligence, attitude, courage, care of young, playfulness, length of life, sanitation.

Relation of characteristics and habits to existence and survival: including movements, attitudes, intelligence, coloration, concealing, disruptive, warning, mimicking.

Breeding habits: including courting behaviour, type of mating (polygamous, monogamous, etc.), dates of mating, associated behaviour, length of gestation period, date and birth of young, condition of young at birth, number of litters per year, relation of male to family, care of young, carrying, feeding, time of weaning, length of time in nest.

Nests and shelters: including dens or shelters for food storage, sleeping, for young, trails to dens, protection by closing burrows.

References

Anderson, R. M., 1919: Canadian Field Naturalist, 33, pp. 86-90 (on mammal study).

Taylor, W. P., 1930: Outlines for studies of Mammalian Life Histories; U. S. Dept. Agri., Misc. Pub. No. 86.

SYSTEMATIC SECTION

Mammal is an awkward word that has not been thoroughly incorporated into English usage. The word animal is often used in a restricted sense to mean mammals only, but animal, properly speaking, includes all living things that are not plants. There is no other English word that is exactly equivalent; beast and quadruped do not include men, bats, and whales.

Mammals are vertebrate animals, with warm blood, and usually with hairy covering; the young are born alive (except in the primitive monotremes of the Australian area) and suckled by the mother.

Mammals belong to one class in the animal kingdom, which is called technically "Mammalia". This is divided into subsidiary groups, into each of which members of closely related animals are placed. In descending order of importance these are: order, family, and genus, and in each genus is one or more species.

Each species has a scientific name that is international, being the same in any language, as well as a vernacular name that varies not only from language to language, but also sometimes from place to place. The scientific species name is composed of two words: the generic name used for all the species in one genus; and the specific name, placed second, used only for the one species. The name of the person who first described the animal is usually given after the name. When the individuals belonging to a species living in one area differ slightly from those living in another part of the range, a third, subspecific, name is often used.

This is best illustrated by taking the first mammal discussed in this volume, the cinereus shrew. *Sorex cinereus cinereus* Kerr is the name of a subspecies of the species. *Sorex cinereus* Kerr, which belongs in the genus *Sorex*, which belongs in the family Soricidae, which belongs in the order Insectivora, which belongs in the class Mammalia.

It is impossible to define a species with complete satisfaction, but it can be broadly defined as a group of individuals that resemble each other in the degree that offspring resemble parents. Usually species do not hybridize, or if they do the offspring is sterile, but this is not always true.

In using the following to identify mammals, one should look on pages 40 to 43 and become familiar with the orders, and decide to which one the individuals belong. The next step is to turn to the order indicated, where synopsis (or keys) to the families will enable one to decide to what family the particular mammal concerned belongs, and by turning to that family, keys to the species will be found.

The keys in this volume always present two alternatives; if it is not one thing it is the other, which offers two further choices until the final identification is reached.

Under each species is given first the English vernacular name, followed by the scientific name. Then is given the size, which is ordinarily total length (from tip of nose to tip of tail, exclusive of the hair); length of tail exclusive of the hair; length of hind foot; length of ear; and height at shoulder is sometimes given. These are of an adult animal, and at least a 10 percentage range of variation can be expected in adults. Then follows an outline of the general characters and colour effect that is thought necessary for identification. Skull characters are sometimes included, as they may be essential for positive identification. Then follows a synopsis of the various subspecies to be found in Alberta, with diagnoses of their characters and synopsis of their ranges. Although species can be identified by the aid of books alone, subspecies usually have to be identified by comparison of specimens.

Then follows a section on the distribution of the species in Alberta, usually adapted from R. M. Anderson's "Catalogue of the Mammals of Canada." Under "Life History" is a synopsis of the reproduction (Kenneth, Gestation Periods, has been consulted freely) and food habits, drawn from a wide variety of sources, and although perhaps not applicable to Alberta conditions, is the nearest guide we have to these subjects. The general section is devoted to some general aspects of the animal and where it lives, and the write-up concludes with selected references, from which data was drawn, and to which the reader is referred.

The order and arrangement follows in general that of Miller, 1924, "List of North American Recent Mammals, 1923."

The data on fur returns are largely from data supplied in mimeographed form by the Dominion Bureau of Statistics.

Measurements are in millimetres as used by scientists generally, unless otherwise indicated. Approximations in inches are usually given after the first measurements under each species write-up.

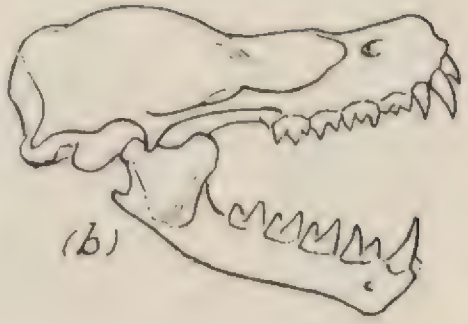

Figure 23. Wing (*a*) and skull (*b*) of a big brown bat.

SYNOPSIS OF THE ORDERS OF ALBERTA MAMMALS

(Based on those species found in the province)

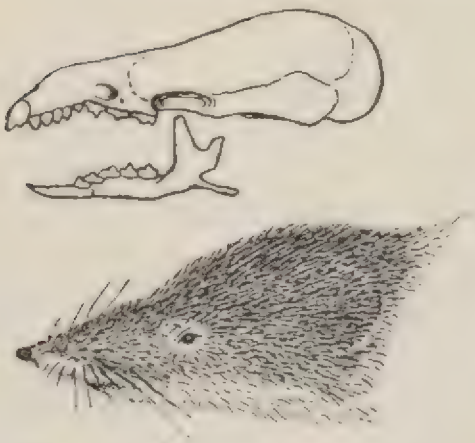

Figure 24. Head and skull of a cinereus shrew.

Only the few key characters necessary for distinction are given here. The reader can soon familiarize himself with these groups, and additional details and subdivisions will be found later in the text.

Order 1—Insectivora (insect eaters). There is one family in Alberta (*See* p. 45), local members of which may be recognized as being tiny to small (the largest less than 200 mm. long); clawed, mouse-like mammals with long pointed snouts and with the jaws filled with simple or generalized teeth with sharp cusps, which are often chestnut tipped; eyes and ears are normal, but very small and inconspicuous.

Order 2—Chiroptera (bats). There is one family (*See* p. 55) represented in Alberta. Its members have their forelimbs modified into wings, and the teeth with many sharp cusps adapted for insect eating; the canine teeth are conspicuous.

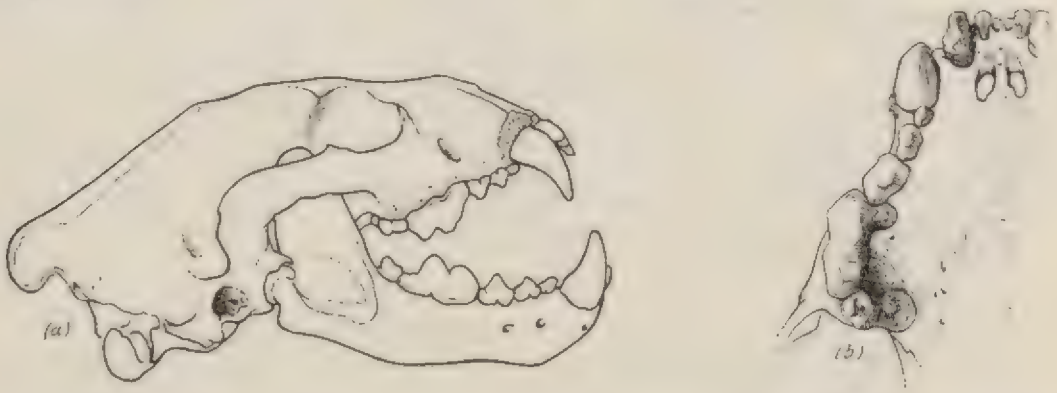

Figure 25. (*a*) Wolverine skull, showing the highly specialized teeth; and (*b*) view of upper tooth row, right side to show shearing edge of molar teeth.

Order 3—Carnivora (carnivores or flesh eaters). There are five families represented in Alberta (*See* pp. 66-69),

whose members may be recognized as being small to large (least weasel 200 mm.; grizzly bear 2·25 m. long); clawed mammals, with adaptations for capturing other animals, most evident in their dentition with the long canine teeth or fangs.

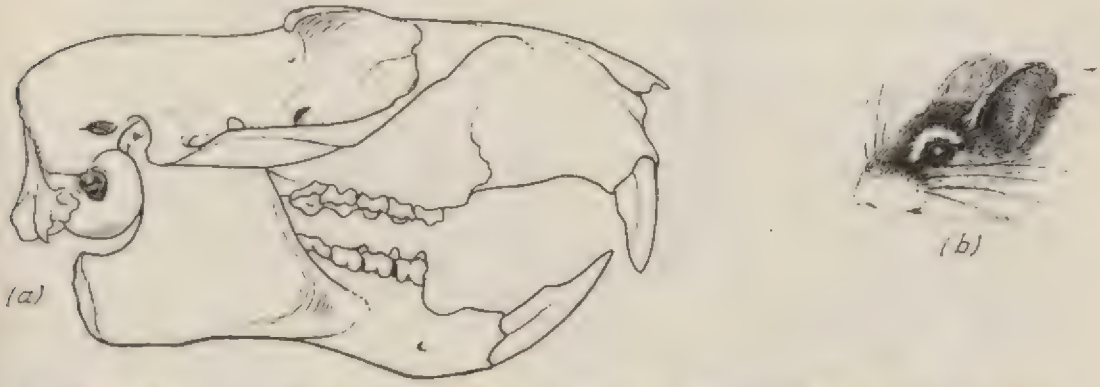

Figure 26. (*a*) Rodent skull (woodchuck) showing the chisel-shaped, gnawing incisors, well separated from the cheek or grinding molar teeth; and (*b*) head of another rodent (white-footed mouse).

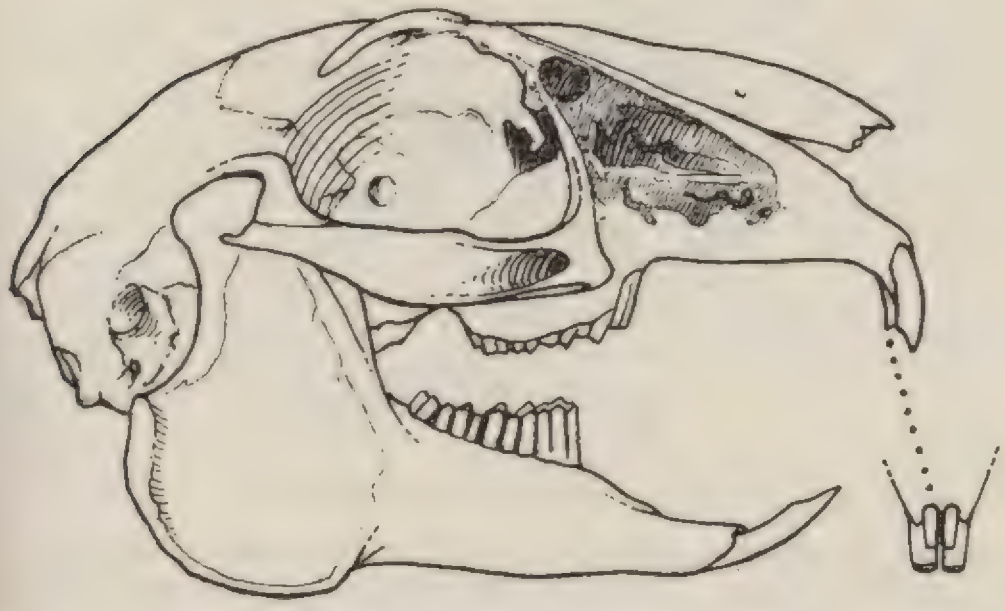

Figure 27. Skull of a lagomorph (snowshoe rabbit) showing the second pair of upper incisors.

Order 4—Rodentia (rodents or gnawing animals). There are seven families represented in Alberta, whose members may be recognized as mostly small (but with one species, the beaver, about one metre long); clawed mammals with their dentition adapted for gnawing; in

both the upper and lower jaws are one pair of chisel-shaped incisors, and between them and the cheek or grinding teeth is a considerable gap.

Figure 28. Skull of a Virginia deer, showing antlers and lack of upper incisors.

Order 5—Lagomorpha (rabbits, hares, etc.). There are two families represented in Alberta, whose members may be recognized as medium sized (175 to 600 mm. long); clawed mammals with gnawing teeth similar to those in rodents, but with two pairs of incisors in the upper jaw, one pair of small, non-functional incisors being situated just behind the functional pair.

Order 6—Artiodactyla (cloven-hoofed mammals). Three families are represented in Alberta, whose members are recognizable as being cloven-hoofed mammals without upper incisors (though some species have canine teeth); many of them bear horns or antlers.

ORDER—INSECTIVORA. INSECT EATERS

There are eight families with over 300 species in this order. They are widely distributed over the world except Australia and most of South America. The members of this order vary in size from the smallest known mammal, a tiny shrew, up to the solenodon of the West Indies, with a body length of somewhat less than 2 feet. They are modified for many ways of living; burrowing, climbing, and swimming. One of the most striking members is the European hedgehog.

In Canada there are two families represented: that of the moles (Talpidae) and the shrews (Soricidae). Only shrews occur in Alberta. Though no moles are found here, the name mole is sometimes applied to a quite different animal, the pocket gopher. The pocket gopher, however, is a rodent, and resembles the mole only in certain habits, perhaps the most conspicuous being that it is seldom seen, whereas the mounds of earth like "mole hills", that it throws up from its underground burrowings are conspicuous.

Moles are found in Eastern Canada as far west as Manitoba, and again in southwestern British Columbia, but are lacking in the intervening area.

FAMILY—SORICIDAE. SHREWS

Shrews are represented by many species all over the world except in most of South America and Australia, that is, over the range of the order Insectivora. Four genera and thirteen species are found in Canada. In Alberta five species occur; all are small, 160 mm. or less in length. Four of them are terrestrial animals, often making little runways through the moss, or through surface litter of dead leaves, and preferring damp habitats. One, the water shrew, is modified for an aquatic existence.

In habit shrews are nocturnal and diurnal; they do not hibernate, but are active throughout the year; their food is composed chiefly of insects and other invertebrates, varied with vegetable matter. They apparently depend much on touch and smell, using their long, flexible snouts more than their eyes in finding food. Their movements are quick and they are active. Some forms swim well, and they have been reported to run over the surface of the water. Their disposition is savage and they fight fiercely with others of their kind; in captivity they attack, kill, and eat small mice. Their appetite is said to be prodigious, and that they eat from one-half to more than three times their weight of food in a day (*Sorex cinereus*). The number of young varies from 4 to 10, born in a naked, nearly helpless condition, and they appear to stay in the nest, under some log or stump, until nearly full grown. Some species are said to make squeaking noises and a purr-like grunt.

Shrews, as insect eaters, have been shown to be important in controlling many forest insects, though in the northwestern United States there is a suggestion that the tendency for certain species to eat Douglas fir seeds may limit the regeneration of that tree.

Shrews are killed by many predators, including fishes, birds, and mammals. Sometimes, however, they are killed and left uneaten, as by cats, perhaps because of the rank, musty odour secreted by their flank glands.

In the late summer and in autumn especially shrews are frequently found dead. Shrews are short-lived animals, with a probable life span of little over a year and perhaps these animals found dead have come to the end of their life span and have simply died of old age.

Though "so little are shrews known to the layman that when actually seen they are generally confused with mice, though in reality as closely related to wolves or foxes as to mice" (Jackson), a number of superstitions have grown up about shrews in various parts of the world. In England it used to be believed that contact with a shrew would cause pain, and the application of a twig of a shrew-ash was the proper treatment to gain relief. A shrew-ash was prepared by inserting a live shrew in a hole in an ash and then plugging the hole. The bite

of the shrew was supposed to cause death. In Alaska the Eskimo believed that shrews encountered on the sea ice might dart at a person, burrow under his skin, and finally reaching the heart cause death.

References

Jackson, 1928: No. Amer. Fauna, No. 51 (revision).
Bell, 1837: A Hist. of Brit. Quadrupeds, London, pp. 111, 112 (includes old British superstitions).
Hamilton, W. J., and D. B. Cook, 1940: Jour. Forestry, 38, pp. 468-473 (shrews beneficial in the forests).

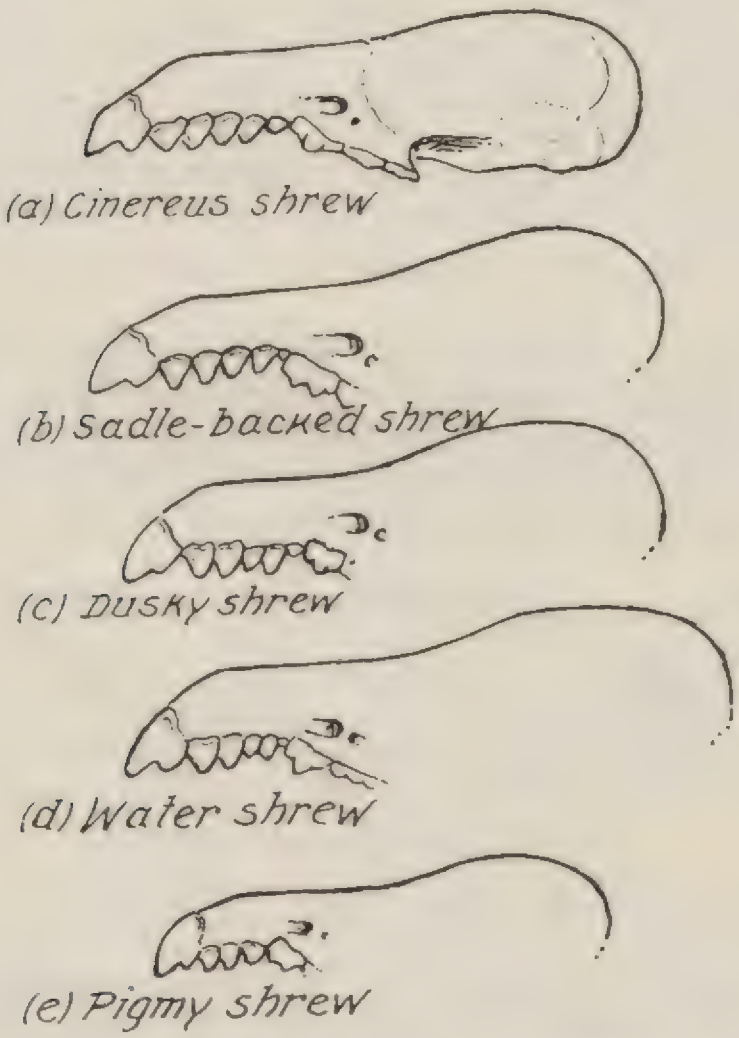

Figure 29. Skulls of various shrews to show the characters of the unicuspid teeth, so useful in some identifications; (*a*) cinereus shrew; (*b*) saddle-backed shrew; (*c*) dusky shrew; (*d*) water shrew; (*e*) pigmy shrew.

Moore, A. W., 1942: Jour. Mammal., 23, pp. 37-41 (on shrews eating Douglas fir seeds).

Hamilton, 1942: Amer. Nat., 76, pp. 216-218 (short life span of small mammals).

KEY TO ALBERTA SHREWS

(1) Size larger, total length 140 mm. or more—water shrew (*Sorex palustris*)
(1a) Size smaller, total length 120 mm. or less 2
(2) Pattern tricoloured; back darkest, sides paler, belly palest 3
(2a) Pattern bicoloured; back and sides about same colour.... 4
(3) Size larger, total length over 105 mm.—saddle-backed shrew (*Sorex arcticus*)
(3a) Size smaller, total length less than 100 mm.—cinereus shrew (*Sorex cinereus*) (race *haydeni*)
(4) Unicuspid teeth in upper jaw apparently 3—pigmy shrew (*Microsorex hoyi*)
(4a) Unicuspid teeth in upper jaw apparently 5..... 5
(5) Third unicuspid tooth smaller than 4th—dusky shrew (*Sorex obscurus*)
(5a) Third unicuspid tooth equal to or larger than 4th—cinereus shrew (*Sorex cinereus*)

Diagnosis. Total length 82-94 mm. (3·2-3·7 in.); tail 22-37 mm.; hind foot 10·5-12 mm.; colour greyish brown to brownish grey above, sides slightly to somewhat paler, shading to grey on belly; skull with 4th unicuspid tooth about equal to or smaller than 3rd.

Figure 30. Cinereus shrew.

Cinereus Shrew. *Sorex cinereus* Kerr

Compared with other similar species it most resembles the pigmy shrew (*M. hoyi*) and the dusky shrew (*S. obscurus*), but the tooth character is diagnostic. The measurements are also useful as a tentative means of identification; the dusky shrew is larger (total length 115 mm. (4·5 in.); tail 48 mm.; hind foot 13 mm.

Geographical Variation. Two subspecies are recognizable in Alberta:

(1) *Sorex cinereus cinereus* Kerr. Total length 93·7 mm. (3·6 in.); tail 37·2 mm.; hind foot 12 mm. (average 14 specimens, Wood Buffalo Park, Soper); a grey-brown animal with sides little paler than back; occupies most of the range of the species in the province, except that of the next. Some animals from the western part of the province (Seba Beach, Egypt Lake) show a tendency toward the Pacific coast form *S.c. streatori* in their larger skull and darker coloration (Allen, Crowe).

(2) *Sorex cinereus haydeni* Baird. Total length 85, 82 mm. (3·3, 3·2 in.); tail 24, 22 mm.; hind foot 10·5, 11 mm. (2 Islay specimens; Soper). Smaller than *S.c. cinereus*, with a shorter tail and paler in colour, with sides distinctly paler than back; occurs in east-central Alberta (2 collected at Islay; these showed an approach to *cinereus* in colour and in the narrowness of rostrum, Soper).

Allen records an albino from Seba Beach.

Distribution in Alberta. Widely distributed from the northern border south to Red Deer River, and in the mountains and foothills to Waterton Park; apparently absent from the southern prairies and from the Cypress Hills.

Life History. Inhabits forest and adjacent grassland; 4 to 10 young born in summer (Fort Chipewyan, June 3, female with 10 embryos, Preble) in a concealed nest, where they stay until nearly full grown; food chiefly insects and other invertebrate animals; enemies: hawks, owls, and carnivorous mammals; often killed and left uneaten by mammals, but sometimes eaten.

General. The "fine lace-like tracks" of cinereus shrews over the snow show them to be active throughout the long northern winter. "When the temperature stands at 40° below zero and constant motion is necessary to keep one from freezing, one can not help wondering that this tiny creature manages to sustain life" (Preble). In Wood Buffalo Park "in the bitterest cold of midwinter they are occasionally found dead on open snowfields or in deep-trenched sled trails in the forest" (Soper). Perhaps they

die from exposure, but their life span is short, a year to 18 months, and they may have come suddenly to the end of their allotted life span.

In summer these tiny animals, foraging over the forest floor, or through the interstices of grass or undergrowth leave little indication of their passing. Traps, baited with oatmeal or bacon, however, yield evidence that they forage actively day or night.

Warden Lacasse of Banff told of a shrew, perhaps this species, coming into his cabin on Bow River in winter some years ago, and eating a hole into the end of a slab of bacon. Through this it entered and ate out the whole of the interior, leaving only a hollow shell.

Though cinereus shrews cause some annoyance to woodland dwellers by entering cabins and caches and eating meat and fat, they may have a beneficial effect on the forests by controlling insects destructive to forest trees.

References

Allen, 1935: Jour. Mammal., 16, p. 223 (albino from Seba Beach).
Blossom, 1932: Jour. Mammal., 13, pp. 136-142 (habits in captivity).
Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 394 (southern Rockies).
Goodwin, 1929: Jour. Mammal., 10, p. 241 (habits in the wild).
Hamilton, 1941: Jour. Mammal., 22, p. 252 (food).
Hollister, 1912: Can. Alpine Jour., Special No., pp. 5, 6 (Jasper area).
Jackson, 1928: No. Amer. Fauna, No. 51 (revision, many Alberta localities).
Morris, 1942: Can. Entomologist, 74, pp. 197-202 (control of spruce sawfly by small mammals).
Preble, 1908: No. Amer. Fauna, No. 27, pp. 242-244 (northern Alberta).
Sheldon, 1936: Jour. Mammal., 17, p. 209 (habits in the wild).
Soper, 1921: Can. Field-Nat., 35, p. 110, 111 (at Islay).
Soper, 1942: Jour. Mammal., 23, pp. 124, 125 (Wood Buffalo Park).

Saddle-back Shrew. *Sorex arcticus* Kerr

Diagnosis. Total length 112·5 mm. (4·4 in.); tail 42 mm.; hind foot 13·5 mm. (Soper, Wood Buffalo Park) back rich dark brown, or brownish black; sides pale brown contrasting sharply with back; underparts greyish, contrasting with sides, giving a tricoloured pattern that is rather distinctive in the adult, though much less striking in the young; skull rather heavy, with large teeth, with 3rd unicuspid tooth subequal to or larger than 4th.

Geographical Variation. Specimens are referable to: *Sorex arcticus arcticus* Kerr.

Distribution in Alberta. Recorded south to Edmonton and Blindman and Red Deer Rivers (Jackson).

Life History. Probably similar to that of the cinereus shrew; Cowan, in the Peace River country, B.C., found nursing females in mid-May.

General. The saddle-back shrew with its red-brown sides and tricolour pattern is the most beautiful of our shrews. Unfortunately it is rare. In Wood Buffalo Park Soper found this one of the rarest small mammals of the region and collected only five in 2 years. It was found in grassy, moist, low places about sloughs, and in the rank vegetation of large meadows. That it may sometimes be common is indicated by Cowan, who found it the most abundant shrew in the Peace River country, in neighbouring British Columbia. There, also, it was taken in wet habitats: meadow mouse runways through sedges in marshlands, in alder swamps, and along streams in aspen forest.

References

Jackson, 1928: No. Amer. Fauna, No. 51 (revision, Alberta localities).

Soper, 1942: Jour. Mammal., 23, p. 124, 5 (habitat measurements, Wood Buffalo Park).

Cowan, 1930: Occ. Papers B.C. Provincial Mus. No. 1, p. 70 (Peace River).

Dusky Shrew. *Sorex obscurus* Merriam

Diagnosis. Total length 109-113 mm. (4·3-4·4 in.); tail 44-45 mm.; hind foot 12·6-13·6 mm. Colour, above brownish, sides about same colour as back, below pale grey; skull with 3rd unicuspid tooth distinctly smaller than 4th.

Externally similar to *S. cinereus* and *Microsorex hoyi*, but distinctly larger; tooth character diagnostic.

Geographical Variation. From British Columbia to Manitoba there is a progressive darkening in colour, making it advisable to recognize by name each end of this series, with the dividing line in Alberta. Thus the following two lightly differentiated races are recognizable in Alberta:

(1) *S.o. obscurus* Merriam. Total length 113 mm. (4·4 in.); tail 45·8 mm.; hind foot 13·6 mm. (average 6 Banff specimens); a lighter coloured form, ranging in the north of the province (Wood Buffalo Park and Athabaska), and along the slopes of the Rockies up to timberline, south to Waterton Lakes Park.

(2) *S.o. soperi* Anderson and Rand. Total length 109·8 mm. (4·3 in.); tail 44·2 mm.; hind foot 12·6 mm. (average 6 Cypress Hills specimens). Similar to (1) but colour considerably darker and more fuscous; skulls very similar but cranium averages higher and more flat-topped; in Alberta found only in the isolated Cypress Hills.

Life History. Similar to that of *S. cinereus;* inhabits forests and adjacent grasslands; often common.

General. This species occurs along with the cinereus shrew, and they are often equally abundant. Approaching timberline the present species is perhaps more common, and goes above timberline more commonly.

References

Jackson, 1928: No. Amer. Fauna, No. 51 (revision).
Anderson and Rand, 1945: Can. Field-Nat., 59, pp. 47-48 (taxonomic).

Water Shrew. *Sorex palustris* Richardson

Diagnosis. Size, largest of our shrews, total length 151-160 mm. (5·9-6·2 in.); tail 72-74 mm. (2·8-2·9 in.); hind foot 20 mm.; hind feet conspicuously fringed with hair for swimming; fur with a silvery sheen; back and sides greyish black to black, more or less grizzled with white; below silvery grey, the paler grey of under sides extending onto upper lips; skull broad and heavy.

Geographical Variation. Two well-marked subspecies are recognizable in Alberta.

(1) *S.p. palustris* Richardson. Total length 160 mm. (6·2 in.); tail 72 mm. (2·8 in.); hind foot 20 mm. (Manitoba, average 3 females, Jackson). A larger form; the dorsal pelage with little or no indication of being grizzled and flecked with white; occurs in the north, south to Edmonton (Jackson).

(2) *S.P. navigator* Baird. Total length 151 mm. (5·9 in.); tail 74·3 mm. (2·9 in.); hind foot 19·9 mm. (average 10 specimens, Waterton Lakes); generally averages smaller than *S.p. palustris*, with longer tail; upper parts much more grizzled and flecked with white; occurs in the Rocky Mountains up to 7,600 feet (Crowe), from Smoky River south to Waterton Lakes. There is a slight tendency toward intergradation with *S.p. palustris* in this area (Crowe).

Distribution in Alberta. The northern part of the province, south to Edmonton, and in the mountains south to the International Boundary.

Life History. Amphibious; 5 to 7 young born in summer; food mostly insects and other small invertebrates; said to eat fish, but this has not been proved by stomach investigations; usually rare.

General. The water shrew is amphibious, and its life is spent along the shores of ponds, lakes, and streams in forest and brushland. Mr. K. Racey of Vancouver was fortunate enough to be able to watch one of these elusive silvery sprites for some time in British Columbia. He writes of it, "We noticed a movement in the water at the base of a tree the roots of which extended into the water. In a moment along came a water shrew. It ran under a log on which we were seated and swam about a small pond behind us. It made a buzzing sound as it travelled rapidly over the water and then it would seize hold of partly submerged branches and run along these to the bottom of the pond . . . The shrew . . . after hunting about for some minutes, ran under some logs and into another small pond where I watched it catch a beetle, climb out on a log, and

Figure 31. Hind foot of water shrew (right) showing the lateral fringe of hair, an adaptation for swimming, as compared with the hind foot of a saddle-backed shrew (left), which lacks this modification.

proceed to devour the insect. It did not touch the food with its feet but held its head high while eating."

References

Racey, K., and I. McT. Cowan, 1936: Report of Prov. Museum, B.C. 1935, p. H19 (habits in B.C.).

Jackson, 1928: No. Amer. Fauna, No. 51 (revision Alberta localities).

Hamilton, 1930: Jour. Mammal., vol. 11, pp. 37, 38 (food).

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, 395 (taxonomy, occurrence in Rocky Mountains).

Bailey, 1936: No. Amer. Fauna, No. 55, pp. 355-356 (habits).

Pigmy Shrew. *Microsorex hoyi* Baird

Diagnosis. The smallest of our shrews; total length 81-85 mm. (3·1-3·3 in.); tail 28-30 mm.; hind foot 10·5 mm.; colour, above brownish, below greyish; the skull when viewed from the side appears to hold only 3 unicuspid teeth.

The small size and short tail are clues to identification; the tooth character is diagnostic.

Geographical Variation. This is evident chiefly in the shape of the skull, necessitating the recognition of two subspecies in Alberta as follows:

(1) *M.h. hoyi* Baird. Total length 81·3 mm. (3·1 in.); tail 30·7 mm.; hind foot 10·5 mm. (average specimens, Jackson); recorded along Red Deer River, and at the forks of Blindman and Red Deer Rivers (Jackson).

(2) *M.h. intervectus* Jackson. Total length 85 mm. (3·3 in.); tail 28 mm.; hind foot 10·5 mm. (a Yukon specimen); very similar in size and colour to *M.h. hoyi*, though slightly greyer in summer pelage; skull more angular with distinctly higher and broader brain case (Jackson); occurs in northern Alberta, south to Entrance (near Jasper) (Crowe).

Distribution in Alberta. Probably the level part of the northern part of the province, and in the mountains of the west, but details remain to be worked out; probably absent from the plains of the southeast.

Life History. Little known, presumably similar to that of *S. cinereus*

General. The pigmy shrew, with an adult weight of as little as 2 to 3 grammes (about $\frac{1}{16}$ to $\frac{1}{10}$ ounce) is the smallest North American mammal.

The distribution and ecology of this tiny animal need to be worked out. What little we know indicates it is similar in habitat requirements to the cinereus shrew, but at times, in some places, the pigmy shrew is the more common.

References

Jackson, 1928: No. Amer. Fauna, No. 51 (revision, Alberta localities).
Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 395 (occurrence at Entrance, taxonomy).
Peeble, 1908: No. Amer. Fauna, No. 27, pp. 248-249 (occurrence in the north, under the name *Microsorex eximus*).

ORDER—CHIROPTERA. BATS

Bats are the only animals that can fly. Other so-called flying mammals like "flying squirrel" have only gliding membranes.

Bats occur in all continental areas and many islands throughout the world, but are largely absent from polar regions.

In size bats vary from small forms with bodies no bigger than that of a mouse up to the huge fruit bats of the old world tropics with a body length of 300 mm. and a wing span of about 1·5 metres. In feeding habits bats are surprisingly diversified; some are insect eaters, catching their prey on the wing (as are all Canadian bats); others are fruit eaters, and natives in the tropics have to guard their bananas and pawpaws from them; others, in South America, feed on the blood of mammals, including man; and others catch fish from the surface of the water and eat them. They are nocturnal, spending the day at rest, and usually hang up-side-down, clinging to their support with their hind feet.

Bats have long been considered beasts of ill omen. In former times in Europe they were much used in working magic, both for good and ill. Occidental people still dislike bats, because they get in ladies hair (this has happened, but is rare) or because they are believed to carry

bedbugs. It is true that bats carry a host of parasites (as do most mammals) including relatives of the bedbug. *Cimex lectularia,* that are parasites on man, but it has not been shown that they transfer them to man.

For a delightful volume dealing with the many interesting aspects of bats and their lives the reader is referred to Dr. Allen's authoritative book.

Only two of the dozen families are represented in Canada, and only one, the Vespertilionidae, in Alberta.

Reference

Allen, 1939: Bats; Harvard Univ. Press.

FAMILY—VESPERTILIONIDAE. SMALL INSECTIVOROUS BATS

This family, of widespread distribution, contains over 300 species in about 40 genera.

In Alberta 8 species have been recorded. They seem limited to timber or brushy areas in Alberta, and absent from the southern plains. They are all small, insect-eating species (our largest species is the hoary bat with a body length of about 130 mm. and a wing spread of about 315 mm.); are usually active only at night; some species spend the day hanging up in buildings or in caves, some hang up in trees; some species are solitary and some gather in considerable numbers in colonies to sleep; frequently the females sleep apart from the males, in separate groups; some species migrate to warmer climates at the approach of winter, others hibernate in caves (the details of their occurrence and behaviour in Alberta are very scanty).

In most species 1 or 2 young are born, but in the red bat 3 or 4 young may be the usual number; these young are carried about by the mother, clinging to her body, on her nightly flights for some time.

One of the habits of certain small bats that has long attracted attention is their ability to avoid obstacles in flight, even when they are blinded. Scientists at Harvard experimented and found that sight was actually a detriment to bats in avoiding wires. They showed that supersonic sounds of some 50,000 vibrations per second (human

Figure 32. Some Alberta bats and shrews: *(a)* water shrew; *(b)* cinereus shrew; *(c)* pigmy shrew; *(d)* saddle-backed shrew; *(e)* hoary bat; *(f)* red bat; *(g)* Say masked bat; *(h)* silver-haired bat; *(i)* little brown bat; *(j)* big brown bat; *(k)* big-eared bat.

Figure 33. Heads of various bats, showing ear shapes: (*a*) red bat; (*b*) big brown bat; (*c*) little brown bat; (*d*) big-eared bat; (*e*) keen bat; (*f*) long-legged bat; (*g*) Say masked bat.

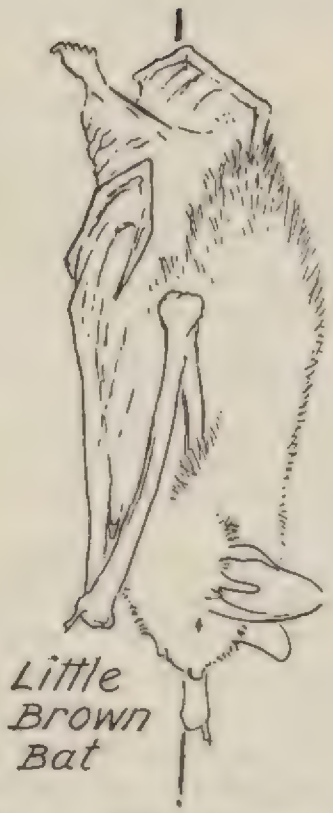

Figure 34. Little brown bat at rest.

ears have a hearing range of sounds with between 20 and 20,000 vibrations per second) uttered by the bats in flight were reflected from obstacles. The bats, hearing these echoes knew where the obstacles were and avoided them.

Reference

Allen, 1939: Bats; Harvard Univ. Press.
Miller and Allen, 1928: Bull. U.S. Nat. Museum, No. 144 (revision of genus Myotis).

KEY TO ALBERTA BATS

(1) Colour black, red, or grey, frosted with white 2
(1a) Colour above uniform to very pale brownish yellow 4
(2) Colour red or grey, frosted with white 3
(2a) Colour black, with white-tipped hairs—silver haired bat (*Lasionycteris noctivagans*)
(3) Size larger, length more than 120 mm. Colour grey—hoary bat (*Lasiurus cinereus*)
(3a) Size smaller, length less than 110 mm. Colour rufous red—red (*Lasiurus borealis*)
(4) Size larger, length more than 110 mm.—big brown bat (*Eptesicus fuscus*)
(4a) Size smaller, length less than 100 mm. 5
(5) Ears large, when laid forward reaching 5 mm. or more beyond nostril—big-eared bat (*Myotis evotis*)
(5a) Ears moderate, when laid forward not reaching much beyond nostril 6
(6) With a definite keel on calcar 7
(6a) With no keel on calcar—little brown bat (*Myotis lucifugus*)
(7) Colour dark brown—long-legged bat (*Myotis volans*)
(7a) Colour pale yellowish brown—Say masked bat (*Myotis subulatus*)

Little Brown Bat. *Myotis lucifugus* LeConte

Diagnosis. Size, total length 92 mm. (3·6 in.); tail 40 mm.; hind foot 11 mm.; ear from notch 12 mm.; forearm 37 mm. (Alberta specimen); wing spread about 240 mm. Ear tapering to tip, when laid forward reaching to or just beyond nostril; no keel present on calcar; membranes unfurred; colour above uniform dark to light brown (varies with the subspecies) with glossy bronze tips to the pelage, below paler to buffy. The young are much darker

and sootier in colour; the ears and membranes are blackish.

Geographical Variation. The details of this need to be worked out, but there appears to be a darkening in colour in the western part of the province, and an increase in the size of the skulls in the animals from the Jasper area. Three subspecies are probably involved.

(1) *M. l. lucifugus* LeConte. Skull averages 14·5 mm. long (Crowe); probably the widespread form.

(2) *M.l. pernox* Hollister. Larger skull, average 15·45 mm. long, recorded from the Jasper area (Crowe).

(3) *M.l. alascensis* Miller. A darker form, with a skull the size of that of *M.l. lucifugus,* has been recorded from Assiniboine (near Banff), and probably occurs in the Banff area at least.

Distribution in Alberta. Occurs throughout in timbered or brush areas.

Life History. Hibernates in caves; food, insects; usually mates in the autumn; one young born in the spring.

General. At dusk these little bats leave their hiding places to fly about with quick, fluttering wing beats.

During the day they congregate in numbers in some dark place. When in an occupied building, their droppings, and their odour cause annoyance, and their scurryings and squeakings worry timid people. Some places when a board nailed to the roof offers shelter, there is a whole line of little muzzles and ears sticking out. When disturbed, it is amazing how active they are, scampering about on all fours and scurrying into other crevices.

When autumn comes they disappear from such places, presumably to some cave for hibernation.

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 395 (taxonomic; status of *M. l. Pernox*).

Miller and Allen, 1928: Bull. U.S. Nat. Mus., No. 144 (taxonomic).

Wimsatt, 1945: Jour. Mammal., 26, pp. 23-32 (breeding behaviour, status of *M. l. Pernox*)

[Keen bat, *Myotis keenii,* is a species that under the name *Myotis subulatus* has been recorded in the older

view of the confusion regarding the species, as well as the names of bats existing then, they are better ignored, and Miller and Allen, 1928, Bull. U.S. Nat. Museum, No. 144, be used as the starting point for our present knowledge of bats in the genus *Myotis*.]

Big-eared Bat. *Myotis evotis* Allen

Diagnosis. Size, total length 85 mm. (3·3 in.); tail 41 mm.; hind foot 7·4 mm.; ear from notch 19 mm. (Washington specimens, Dalquest). Ears narrow and conspicuously large; when laid forward reaching about 5 mm. beyond nostrils; calcar ordinarily without, but sometimes with, a rudimentary keel; membranes largely unfurred; colour, above light brown to tow colour, paler below; ears and membranes brownish black.

Geographical Variation. The specimens from the Rocky Mountains are distinctly darker than those from the plains, necessitating the recognition of the two following races:

(1) *Myotis evotis evotis* Allen. A pale yellowish or tow-coloured form, recorded from Red Deer River near Rumsey.

(2) *Myotis evotis pacificus* Dalquest. A darker form, has been recorded from the vicinity of Jasper and Waterton Lakes.

Distribution in Alberta. The west and southern forested parts of the province, recorded in the foothills of the Rockies and on Red Deer River near Rumsey.

General. There seems to be little known about this bat. It is said to be quick and strong flying, and to frequent both caves and hollow trees, but not to gather into large colonies. It may well be found wintering in the caves and crevices along Red Deer River.

Reference

Bailey, 1936: No. Amer. Fauna, No. 55, pp. 372-375 (habits in Oregon).

Long-legged Bat. *Myotis volans* Allen

Diagnosis. Size, total length 97 mm. (3·8 in.); tail 42 mm.; hind foot 8 mm.; ear from notch 10 mm.; forearm 37 mm. Wing spread about 240 mm. (9·4 in.) (British Columbia specimens); ears moderately narrow and pointed, short, barely reaching nostril when laid forward; calcar distinctly keeled; colour, above dark brown, below paler; ears and membranes blackish, membranes largely unfurred.

The presence of the keel on the calcar is diagnostic; other distinctive features are the combination of short foot, short ear, and dark coloration.

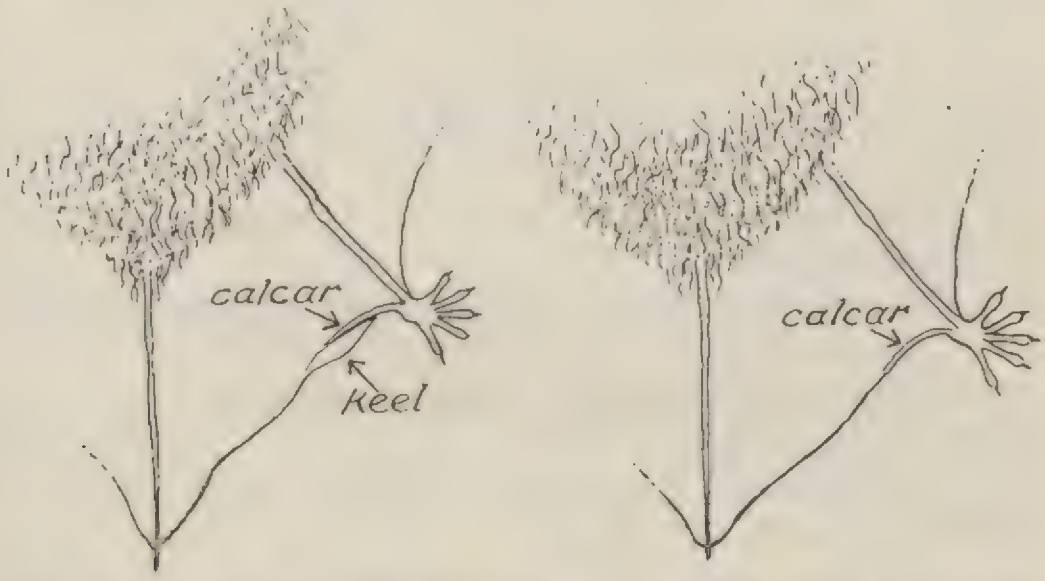

Figure 35. Tail, right hind foot, and part of interfemoral membrane of (left) long-legged bat, showing keel on calcar; and (right) little brown bat, showing lack of keel on calcar.

Geographical Variation. Though several races are recognizable to the south of us, only one occurs in our area, as follows: *M.v. longicrus* True.

Distribution in Alberta. The western part of the southern half of the province, recorded in the Rocky Mountains, and east to Dried Meat Lake (southeast of Edmonton).

General. Vernon Bailey, the veteran field naturalist and mammal student of the United States, writes that so little is known of the habits of this species that every

record should contribute a valuable bit of information.

Hollister records a specimen from Henry House as flying about with other small bats in the evenings in the shelter of the Douglas fir groves.

References

Miller and Allen, 1928: Bull. U.S. Nat. Mus., No. 144 (taxonomy).
Bailey, 1936: No. Amer. Fauna, No. 55, p. 376 (habits).
Hollister, 1912: Can. Alpine Jour., 4, pp. 7, 8 (Henry House record).

Say Masked Bat. *Myotis subulatus* Say

Diagnosis. Size small, total length 82 mm. (3·2 in.); tail 35 mm.; hind foot 6 mm.; ear from notch 10 mm.; forearm 33 mm. (a female from Red Deer River); ear rather narrow and tapered; when laid forward reaches or extends slightly beyond nostril; a well-developed keel on calcar; membranes largely unfurred; colour pale yellowish brown, paler brown, with face black. Ears and membranes are blackish.

The small size, short foot, pale coloration, and black face are distinctive.

Geographical Variation. Only one subspecies occurs: *M.s. subulatus* Say.

Distribution in Alberta. Known only from Red Deer River, near Rumsey.

Life History. Hibernates in caves; food, insects; 1 or 2 young born in the spring.

General. This tiny, pale-coloured bat has the just and prior claim to the name *subulatus*, though this was not recognized until recently. Formerly *Myotis subulatus* was used commonly for the larger, long-eared bat now known as *Myotis keenii*, and which is not known to occur in Alberta.

Silver-haired Bat. *Lasionycteris noctivagans* LeConte

Diagnosis. Size, total length 98 mm. (3·8 in.); tail 43 mm.; hind foot 11 mm.; ear from notch 12 mm.; forearm 39 mm.; wing spread about 280 mm. (11 in.) (male, Red Deer River); ear wide and blunt; colour brownish black to black, with many hairs white tipped (hence the name), especially on the upperparts; ears and membranes blackish. Colour is a diagnostic character of this species.

Geographical Variation. No subspecies recognizable.

Distribution in Alberta. Probably occurs throughout in forested areas; specimens from Jasper area and Red Deer in National Museum.

Life History. Migrates southward for the winter; food, insects; 1 to 2 young born in spring.

General. Mr. F. H. Riggall tells us that in the Twin Butte area he usually finds this species during the day under the bark of burned spruces, where the bark has blistered and curled up. The bats usually betray their presence by squeaking when one rides past.

Big Brown Bat. *Eptesicus fuscus* Beauvois

Diagnosis. Size, total length 120 mm. (4·7 in.); tail 42 mm.; hind foot 12 mm.; ear (dry) 13 mm.; forearm 45 mm. (male, Red Deer River); wing spread about 290 mm. (11·4 in.). Ear rather rounded; membranes largely unfurred; colour, pale uniform brown above, paler to whitish below; ear and membranes blackish.

Geographical Variation. In western British Columbia this species is very dark, in eastern Canada it is moderately dark, and on the prairies it is pale. This pale form is the one occurring in Alberta and is known as: *E.f. pallidus* Young.

Distribution in Alberta. Probably occurs in timbered areas throughout; recorded from Waterton Lakes to Wood Buffalo Park.

Life History. Hibernates in caves and in buildings; food, insects; mates in autumn; 2 (sometimes 1) young born in the spring.

General. The big brown bat sleeps away the day in some old building, in a hollow tree, or other crevice. At dusk, usually a little later than the small brown bat, it emerges to fly about catching its insect food. Its flight is steadier and with a slower wingbeat than the quick, fluttering flight of the smaller bats.

References

Allen, 1933: Can. Field-Nat., 47, pp. 31, 32 (taxonomic).
Hamilton, 1933: Jour. Mammal., 17, pp. 268-273 (food).
Wimsatt, W. A., 1945: Jour. Mammal., 26, pp. 23-32 (breeding behaviour, eastern United States).

Red Bat. *Lasiurus borealis* Müller

Diagnosis. Size, total length 105 mm. (4·1 in.); tail 40 mm.; hind foot 7 mm.; ear 9 mm.; forearm 39 mm. (Manitoba specimens). Ear short, broad, and rounded at tip; upper surface of interfemoral membrane densely furred; colour yellowish red or rufous red, often frosted with white, especially above.

The colour, size, and furred upper side of the interfemoral membrane are distinctive.

Geographical Variation. On the Pacific coast a dark form occurs; eastward is a pale form, *L.b. borealis* Müller, that occurs in Alberta.

Distribution in Alberta. Probably widespread in forested areas, but data scanty.

Life History. Roosts hanging amongst the foliage of trees; migrates southward in winter; food, insects; 1 to 4 young born in the spring.

General. The distinctive, beautiful colour of this bat makes it an aristocrat among our bats, and its habits of migrating, and of roosting amongst the foliage of trees set it off sharply in habits from the brown, cave-inhabiting bats.

Reference

Lyon, 1903: Proc. U.S. Nat. Mus., 26, pp. 425, 426 (reproduction).

Hoary Bat. *Lasiurus cinereus* Beauvois

Diagnosis. Size, largest of our bats, total length 128 mm.; tail 58 mm.; hind foot 17 mm.; ear (dry) 12 mm.; forearm 55 mm. (Saskatchewan specimen); wing spread about 315 mm.; ear short, blunt, and rounded at tip;

upper surface of interfemoral membrane densely furred; colour yellowish brown or grey, heavily frosted with white above and below.

Geographical Variation. None.

Distribution in Alberta. Probably breeds in northern forests and migrates through the southern, wooded parts.

Life History. Roosts amongst foliage of trees; migrates south in winters; food, insects; young 2 (sometimes 4?) in spring.

General. This is the largest and most striking of our bats. Though sometimes said to breed only in the boreal forests, it has been found breeding in the northern United States. An occasional wanderer goes far north into the barren grounds, as a record from Southampton indicates.

References

Hitchcock, 1943: Can. Field-Nat., 57, p. 86 (Southampton Island record).

McClure, 1942: Jour. Mammal., 23, pp. 430-434 (summer habits, breeding, Iowa).

ORDER—CARNIVORA. CARNIVORES, OR FLESH-EATERS, OR BEASTS OF PREY

This order is often used to include the seals as well as the terrestrial beasts of prey, for seals are beasts of prey adapted for an aquatic existence. The order as here used does not include the seals.

The carnivores have a widespread distribution, though in Australia they have only one representative, the dingo, that may have been introduced by early man. They are most numerous as to species in the African and southern Asiatic areas.

Our familiar dogs and cats are representatives of two families; the ferret, used in hunting rabbits, is another; and the bear of circuses is another.

Most members of this group are especially modified for capturing other vertebrate animals by stealth or by pursuit, but a few such as the bears and pandas now have

largely a vegetable diet. In the diet of some other forms insects are very important, as with our skunks, and others are primarily carrion-eaters, such as the hyenas.

The young are born in an undeveloped state and are dependent on the parents caring for them in a nest or a shelter for a longer or shorter length of time.

Few members of this group have been extensively domesticated, though the dog is widely used in hunting, and in certain areas as a draught animal. Many wild species provide important furs, and foxes and mink are being ranch-raised for this purpose. The beasts of prey have perhaps attracted more attention by the losses they have caused man. Lions and tigers sometimes become man-eaters, as well as destroying stock; wolves, especially in the old world, have been dangerous to man, and in the new world they have been considered enemies of stock, and of other more desirable big game species of mammals. Smaller species are accused of killing lesser livestock, such as coyotes killing sheep and turkeys, and foxes and weasels killing chickens.

Of the seven families usually recognized, two, the Hyaenidae (hyenas) and the Viverridae (civits, mongoose, etc.), are not American. Representatives of the other five families occur in Alberta.

SYNOPSIS OF FAMILIES

(Based on Alberta species)

Family 1—Ursidae (bears). Size large, over one metre long; body stout, legs short, feet plantigrade with five functional toes on each foot; claws well developed, non-retractile; tail rudimentary; muzzle somewhat elongate; premolars lost at an early age; cheek teeth tuberculate and adapted for crushing (p. 68).

Family 2—Procyonidae (raccoons, etc.). Our one Alberta form is a medium-sized animal (length about 850 mm.); body stout; feet slender, plantigrade, with five functional claws on each foot; claws non-retractile; tail of

moderate size, marked with dark-coloured rings; muzzle elongate; cheek teeth tuberculate and adapted for crushing (p. 75).

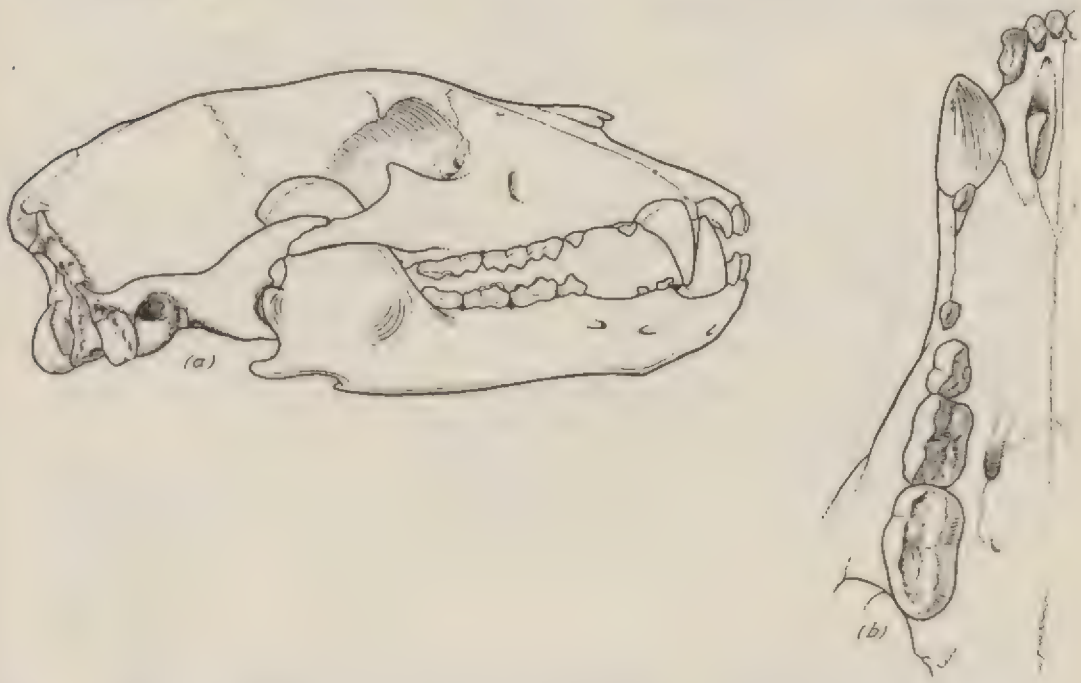

Figure 36. (*a*) Side view of black bear skull; and (*b*) view of upper teeth, right side, of bear, to show broad, crushing cheek teeth.

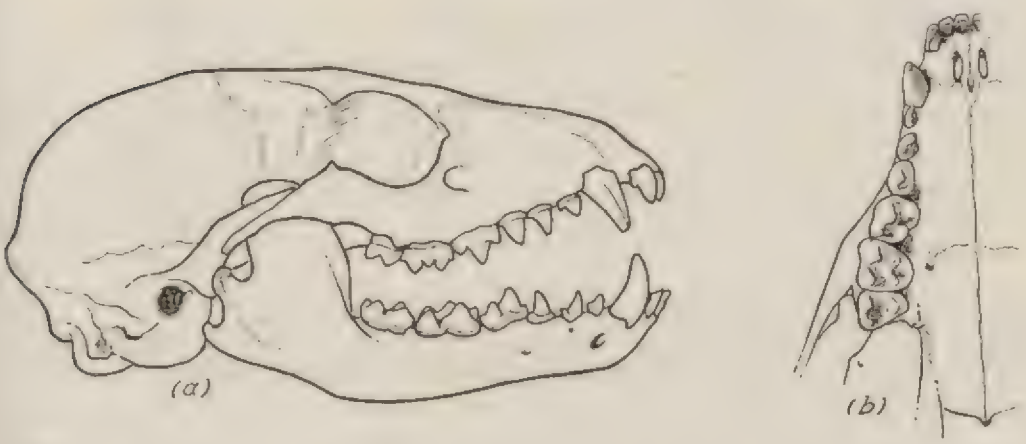

Figure 37. (*a*) Raccoon skull, side view; and (*b*) view of upper teeth, right side, to show crushing shape of cheek teeth.

Family 3—Mustelidae (weasels and their relatives). Variable as to size and shape; small to medium-sized animals (200 mm. to 1·25 metres long); slender to bulky in shape; legs short; feet plantigrade, some digitigrade;

five functional toes on each foot; claws retractile or non-retractile; tail moderately developed; skull with an elongated brain case and a shortened facial part; cheek teeth modified for shearing and cutting (p. 78).

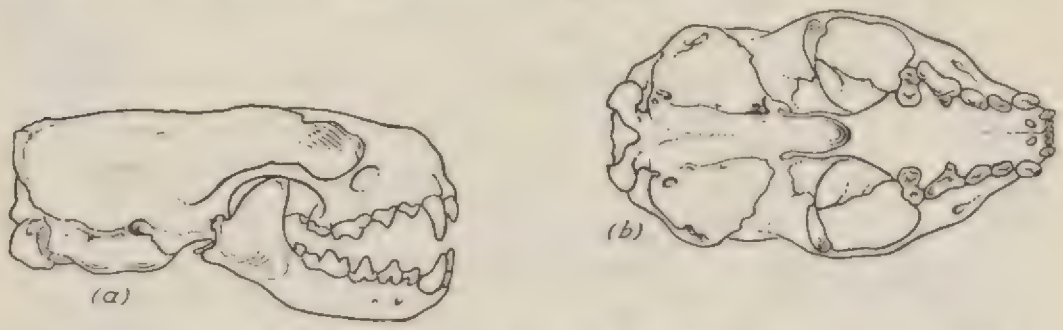

Figure 38. (*a*) Mink skull, side view; and (*b*) lower view (without mandible).

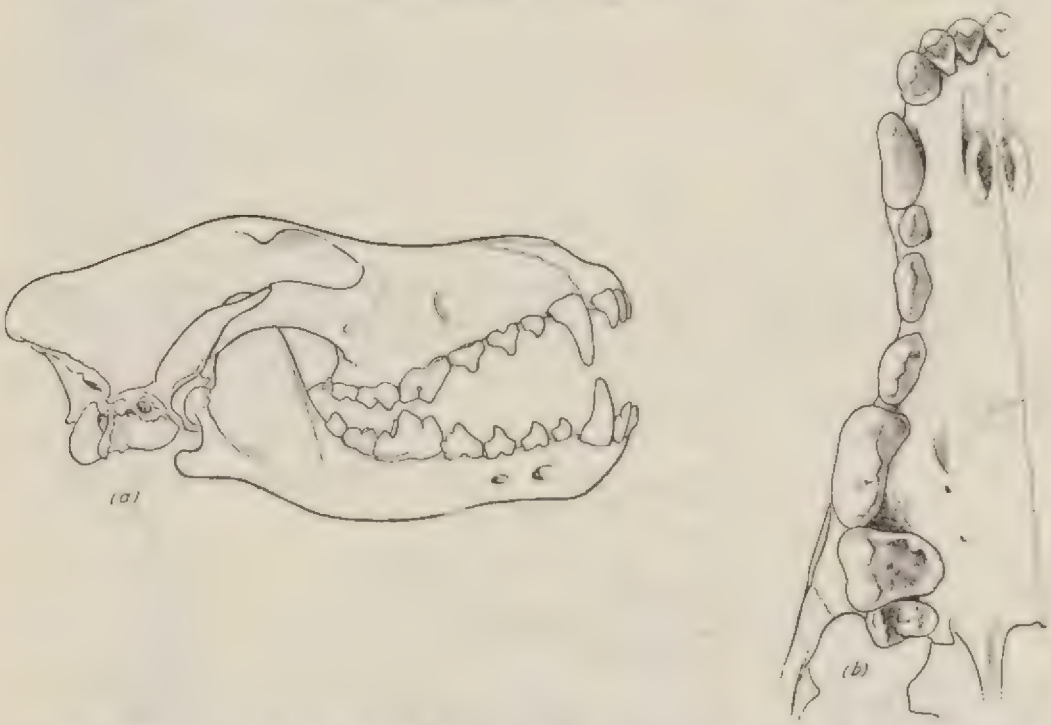

Figure 39. (*a*) Wolf skull, side view; and (*b*) view of upper teeth, right side, to show shearing shape of some cheek teeth.

Family 4—Canidae (dogs, wolves, etc.). Medium-sized to large, dog-like carnivores; length 800 mm. to 2 metres; legs rather long; feet digitigrade with four functional toes and one rudimentary toe on the front foot, and four toes on the hind foot; claws blunt, non-retractile; tail well developed; muzzle elongate; cheek teeth modified for shearing (p. 102).

Family 5—Felidae (cats and their relatives). Size, medium to large, length 1 metre to 2·8 metres (40-112 in.); legs moderately long; feet digitigrade; toes five (one rudimentary) on fore feet, four on hind feet; claws sharp, retractile; tail long or short; head blunt and rounded; cheek teeth modified for shearing (p. 116).

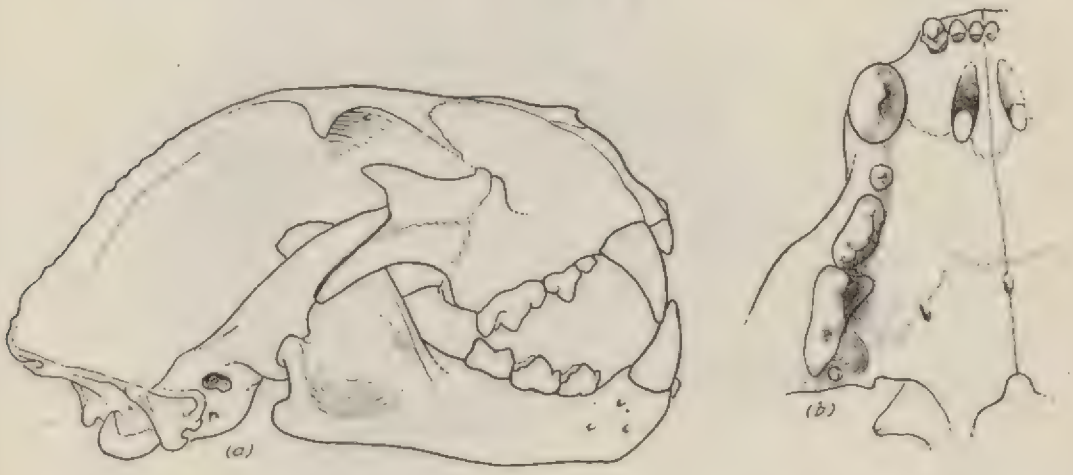

Figure 40. (*a*) Cougar skull, side view; and (*b*) view of upper teeth, right side, to show shortened tooth row and shearing type of cheek teeth.

FAMILY—URSIDAE. BEARS

The bears are mainly northern in distribution, occurring in North America, Europe, Asia, and in northern South America and northwest Africa. They are all rather similar in general appearance. The polar bears are semi-aquatic; the black bears and their Asiatic relatives are partly arboreal; our grizzly bears are terrestrial.

Recent extreme authors have recognized a host of species in certain groups, notably the grizzly-big brown assemblage. Older authorities considered only few species necessary, and pointed out the close relationship between the grizzly and brown bears of North America and the brown bears of northern Asia and Europe.

Bears are largely vegetarians, insect eaters, and scavengers. Our species hibernate during the winter months. They mate in the summer; the young are born in a very small helpless state while the female is in

hibernation the following winter. They take more than one year to reach maturity, and it seems that the females do not mate every year.

Figure 41. Head of black bear.

KEY TO ALBERTA BEARS

Colour usually brownish; hump on shoulder evident; fore claws much longer than hind claws—grizzly bear (*Ursus horribilis*).

Colour brown or black; no hump on shoulder; fore claws about equal hind claws in length—black bear (*Ursus americanus*).

Black Bear; Brown Bear. *Ursus americanus* Pallas

Diagnosis. Size, total length up to 1,400 mm. (55·1 in.); tail 90 mm. (3·5 in.); ear from notch 128 mm.; height at shoulder 730 mm. (28·7 in.); weight about 350 pounds (a Waterton Lakes female). A large bulky animal; eyes small, ears conspicuous, tail inconspicuous; front claws about same length as hind claws; colour generally black or brown; muzzle brown; often a white mark appears on the throat.

Geographical Variation. In eastern Canada the pelage is usually black; in the Rocky Mountains a brown colour phase is of not uncommon occurrence; on parts of the

British Columbia coast a white phase occurs; in southeast Alaska a bluish phase occurs; geographical variations in size, and skull characters, are used for characterizing subspecies. In Alberta the following subspecies are given by Anderson.

Figure 42. Black bear: (*a*) front paw showing short claws; and (*b*) an enlarged front claw.

Ursus americanus americanus Pallas. A medium-sized black bear, in which the brown colour phase is rare; skull, condylobasal length 266·5 mm., zygomatic breadth 178 mm.; recorded from Wood Buffalo Park, but specimens show an approach to the next form.

Ursus americanus cinnamomum Audubon and Bachman. A rather large bear showing the brown or cinnamon phase more commonly than the eastern bears; skull heavier and more massive, condylobasal length 277 mm., zygomatic breadth 195 mm.; recorded in the Rocky Mountains.

It should be noted that frequently the black bears are placed in the separate genus *Euarctos*. In this paper the more inclusive genus *Ursus* is used.

Distribution in Alberta. Wooded areas in the northern half of the province, and the Rocky Mountains.

Life History. Probably mates in midsummer; hibernates over winter; 1 to (rarely) 4 young born during hibernation; feeds on a wide variety of animal and vegetable foods, including berries, grass, bark, roots, insects, and any meat, carrion, or garbage available.

General. The dozen or two black bears that feed regularly in the garbage pit at Jasper are one of the sights of the place. As the garbage truck appears the bears

Figure 43. Two black bears playing in a tree near Jasper.

gather from the forests and completely disregard humans. They can be fed from the hand, but it is a dangerous practice, for the bears are still wild, powerful animals no matter how clumsy, clownish, and tame they appear.

Figure 44. Feet of black bear (from skin).

About camps they may become a nuisance, as the following account from Mr. H. A. deVeber of Waterton Lakes Park illustrates. One day in 1942, in a cottage near the superintendent's house, the lady of the house had been baking and preserving. The preserves had been placed in

the ice box, the pies on the verandah to cool, and the family had gone out. On their return a mother bear and her two cubs were in possession, having entered by the simple method of tearing the screen off the door. The place was in a mess such as only bears can make. The pies had been eaten, the ice box knocked over and damaged, and the floor covered with a mixture of plum syrup, pickles, milk, rolled oats, and broken dishes.

Though a game animal, it is so widespread that it is not much of a sportsman's attraction in remote areas. The flesh of the black bear may be delicious, and would be more widely used were it not for the common prejudice against the flesh of clawed animals. The hide is of little value in the market, and usually is not worth the trouble of preparing.

References

Anderson, 1945: Ann. Rept. 1944 Prov. Soc. Nat. Hist., Quebec, pp. 17-33 (revision).
Rowan, 1945: Jour. Mammal., 26, p. 197 (number of young).

Grizzly Bear. *Ursus horribilis* Ord

Diagnosis. A medium-sized to large bear; total length 2,234 mm. (88·4 in.); hind foot 201 mm. (2·8 in.); height at shoulder 1,371 mm. (54 in.) (a British Columbia female); shoulder with a pronounced hump, due in part at least to an area of longer fur; claws of front feet much

Figure 45. Grizzly bear, showing hump over shoulders: (*a*) front paw with elongated fore claws; and (*b*) an enlarged fore claw.

longer than those of hind feet; head and shoulders appear much broader than those of a black bear; colour variable, usually brown tipped or grizzled with yellowish, or whitish (thus the name).

The hump on the shoulder and the more bulky appearance of the foreparts, taken with the colour, are the best field characters. In the tracks the conspicuous claw marks of the front footprints, extending well beyond the ends of the toes, is diagnostic.

The relationships and identity of the many grizzlies, big browns, and Alaska bears are not properly understood. The following forms have been recorded from Alberta by Anderson:

Ursus horribilis horribilis Ord
Ursus horribilis dusorgus Merriam
Ursus horribilis imperator Merriam
Ursus canadensis canadensis Merriam
Ursus canadensis rungiusi Merriam
Ursus hylodromus Elliot
Ursus kluane impiger Merriam
Ursus latifrons Merriam

However, existing taxonomic treatments are unsatisfactory and here the grizzly bears of Alberta are uncritically grouped under the oldest name, *Ursus horribilis.*

Distribution in Alberta. Chiefly in the Rocky Mountains; occasionally to Lesser Slave Lake; formerly common on the plains of the Prairie Provinces, where skulls are still occasionally found. Any skulls of these extinct grizzlies of the plains that are found should find permanent housing in a Museum.

Life History. Probably mates in spring or early summer; breeds every 2 or 3 years; hibernates (though not as profoundly or as long as does the black bear); 1 to (rarely) 3 young born to the female while in hibernation; food, roots, berries, herbaceous vegetation, carrion, small mammals, and often large mammals.

General. The grizzly bear that used to roam the plains is gone, and now these bears are largely restricted to the mountains. Usually wilder and shyer than the black bears, their presence is incompatible with human occupation, and we can expect it to survive only in remote areas. It still is common in such mountain habitats, especially near and above timberline, where it digs out ground squirrels and whistlers, and feeds on roots and herbaceous matter.

In some areas it does not molest domestic stock, but in others it does. Usually in the presence of man it flees, but there are rare exceptions as the case quoted by Major J. A. Wood, when at Miette a man sent his dog after a grizzly and cub that came about his cabin. The bear turned on the dog and chased it back to where the man was standing. The man climbed a tree and was kept there some time before the bears retired.

References

Anderson, 1946: Catalogue of Canadian Recent Mammals (list of species).

Rowan, 1945: Jour. Mammal., 26, p. 197 (number of young).

FAMILY—PROCYONIDAE. RACCOONS AND THEIR RELATIVES

This family includes a number of striking and rather well known species, such as our raccoon, the kinkajou and the coati of the American tropics, and the pandas of southern Asia (though the giant panda at least is sometimes thought to be related more closely to the bears). The raccoon has long and mobile fingers that it uses like hands, is easily tamed, and makes an engaging, though some times exasperating, pet.

Raccoon. *Procyon lotor* Linnaeus

Diagnosis. Size, total length 850 mm. (33·4 in.); tail 265 mm. (10·4 in.); hind foot 125 mm. (4·9 in.); skull, greatest length 127·1 mm. (5 in.) (a male from North Dakota, Nelson and Goldman); colour greyish or brownish, the fur tipped with black; a black patch on each cheek; tail slightly bushy and ringed with dark and light; fur rather long, dense, and somewhat coarse.

Geographical Variation. The form that occurs is *Procyon lotor hirtus* Nelson and Goldman.

Distribution in Alberta. Southern Alberta north to Red Deer River and Banff; rare; escaped captives have been seen farther north. There is an amazing record for Wood Buffalo Park.

Life History. Does not venture out in severe weather, but no true hibernation; nocturnal; sleeps in hollow trees, probably caves, and sometimes in old, large bird nests; 3 to 6 young born in the spring; young remain in the nest for some time; food includes berries, grain, insects, fish, frogs, and small mammals.

Figure 46. Raccoon studies, head and tail.

General. Forested watercourses and their vicinity are favourite raccoon habitats. It climbs and swims well.

The specific name of the raccoon, *lotor*, meaning the washer, refers to its habit of washing its food in water. The food is often, but not always, put in water and patted or treaded with the front feet before being eaten.

The raccoon is too scarce to be of great value as a fur bearer in Alberta. The annual total value of the raccoon taken from Alberta in the period 1919-20 to 1941-42 has varied from nil to $955; the average value per pelt has varied annually from $2.25 (1934-35) to $7 (1929-32).

The Alberta raccoon yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	191	1930-31	4
1920-21	27	1931-32	24
1921-22	...	1932-33	34
1922-23	3	1933-34	130
1923-24	...	1934-35	31
1924-25	...	1935-36	100
1925-26	...	1936-37	142
1926-27	16	1937-38	38
1927-28	31	1938-39	26
1928-29	9	1939-40	98
1929-30	18	1940-41	26
		1941-42	38

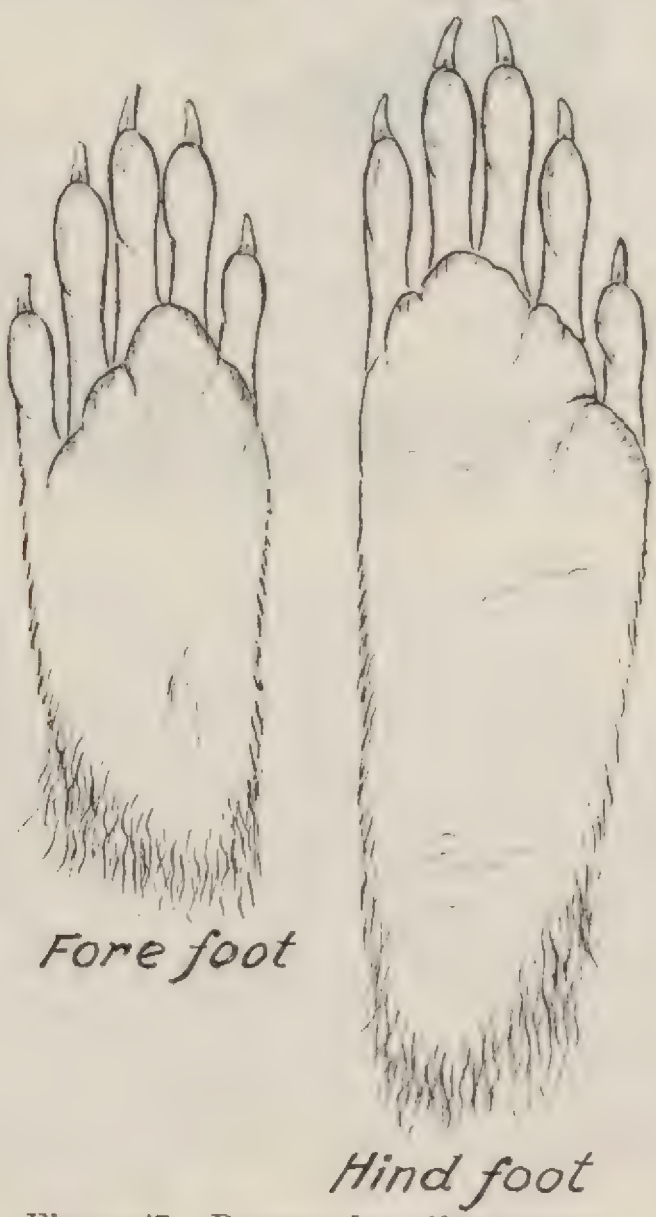

Figure 47. Raccoon feet (from skins).

References

Nelson and Goldman, 1930: Jour. Mammal., 11, pp. 453-459 (taxonomic).
Hamilton, 1936: Ohio Jour. Sci., 36, pp. 131-140 (life history).
Soper, 1942: Jour. Mammal., 23, pp. 126-127 (Wood Buffalo Park).
Nagel, 1943: Missouri Conservationist, 4, pp. 6, 7 (weights in Missouri—5,371 males averaged 14·9 pounds; 2,809 females, 13·1 pounds).

FAMILY—MUSTELIDAE. WEASELS. WEASELS AND THEIR ALLIES

This family contains a number of very different appearing animals, varying in size from medium to very small, better considered under their subfamily headings. As a group the family is of widespread distribution, except for Madagascar and the Australian area.

The young of all Alberta forms are born in a helpless state in some shelter or burrow where they stay for some time, cared for by the parent.

The typical weasels are highly carnivorous, but some of their relatives, such as the skunks, are omnivorous. The possession of a pair of anal glands, secreting a strong-smelling fluid, characterizes many forms. This is best developed in the skunk. Some, such as the skunks, hibernate in our latitudes; others are active throughout the year. Most species are largely nocturnal. Five subfamilies are represented in Alberta.

SYNOPSIS OF SUBFAMILIES OF MUSTELIDAE IN ALBERTA

(Based on species occurring in the province)

Subfamily 1—Mustelinae (weasels, marten, fisher, mink, etc.). Body slender; legs short; feet digitigrade; toes partly webbed; claws short, sharp, and semi-retractile; tail short to moderate, cylindrical to bushy; fur short to moderately long (p. 79).

Subfamily 2—Guloninae (wolverines). Size, large (for the family); body stout; legs short; feet sub-plantigrade; claws rather short and blunt; tail moderate and bushy; fur very long; colour pattern dark brown, with grey on nape and yellowish band on each side of body distinctive (p. 93).

Subfamily 3—Lutrinae (otters). Size medium to large (for the family); body slender; legs short; toes webbed; claws short (absent in some exotic forms); tail long and tapering; fur short and dense (p 95).

Subfamily 4—Mephitinae (skunks). Size medium; body stout; legs short; feet nearly plantigrade; toes not webbed; fore claws lengthened, fossorial; tail bushy, medium to long; anal glands well developed; distinctive black and white coloration; fur medium to long (p. 97).

Subfamily 5—Taxidinae (badgers). Size medium to large; body stout, flattened; legs short; feet subplantigrade, broad; toes not webbed; fore claws much lengthened, fossorial; tail short and bushy; fur rather long (p. 99).

Subfamily—Mustelinae. Weasels, Marten, Fisher, Mink,, Etc.

This subfamily includes our typical weasels and ermine, the marten, fisher, and mink, as well as such well known old world forms as the stoat, ferret, polecat, and sable. The distribution of the subfamily is widespread, occurring in Europe, Africa, Asia, and the Americas. Its members are highly carnivorous, most of them feeding on warm-blooded vertebrates, but some eat many insects, and fish and frogs. Some are terrestrial, some are partly aquatic, and some partly arboreal.

Many fine furs are produced by the members of this family in northern climates, and the fisher produces what is perhaps the most costly of our pelts at the present time.

Seven species occur in Alberta.

KEY TO ALBERTA SPECIES

(1) Body below white (sometimes also white above) 2

(1a) Body mostly brownish below, often with white or orange markings 5

(2) Feet black—black-footed ferret (*Mustela nigripes*).

(2a) Feet not black 3

(3) Conspicuous black tip to tail 4

(3a) No conspicuous black tip to tail—least weasel (*Mustela rixosa*)

(4) Total length over 350 mm. (13·7 in.)—long-tailed weasel (*Mustela frenata*)

(4a) Size smaller, total length less than 350 mm. (13·7 in.)—short-tailed weasel *(Mustela erminea)*

(5) Total length over 800 mm. (31·4 in.)—fisher (*Martes pennanti*)
(5a) Size smaller, total length less than 800 mm. (31·4 in.).... 6
(6) Ears large (Figure 48a), throat orange (usually)—marten (*Martes americana*)
(6a) Ears small (Figure 48b) chin and throat often with white patches—mink (*Mustela vison*)

Figure 48. Head of: (*a*) marten showing large ears; and (*b*) mink showing small ears.

Marten. *Martes americana* Turton

Diagnosis. Size, male, total length 596-665 mm. (23·5-26 in.); tail 181-223 mm. (7·08-8·75 in.); hind foot 95-109 mm. (3·7-4·3 in.); female considerably smaller; size varies with the subspecies; a medium-sized, slender-bodied, short-legged, bushy-tailed (in good pelage) tree weasel; colour varies with the race and the season, in general yellowish brown, brown, or greyish brown, with orange tones; darker posteriorly, on tail, and on legs; much the same below, but with an irregular shaped yellowish white to orange patch on chest.

Geographical Variation. The following three subspecies occur:

(1) *Martes americana abieticola* Preble. Total length 640 mm., tail 210, hind foot 95 (type, Preble); average of six skulls, Oxford House, Man., occipitonasal length 78·9; zygomatic breadth, 47·8 (Preble); a rich dark yellowish brown animal in winter pelage; includes the animals from northeast Alberta.

(2) *Martes americana abietinoides* Gray. Total length 596 mm., tail 181, hind foot 96 (a Banff male); a small dark brown form; includes the animals of the Rocky Mountains.

(3) *Martes americana actuosa* Osgood. Total length 665 mm., tail 223, hind foot 109 (average four adult males, Fort Yukon, Osgood); a large, pale brownish or greyish race; includes the northwestern Alberta animals.

Distribution in Alberta. In the northern and western coniferous forests.

Figure 49. Marten.

Life History. Active throughout the year; arboreal and terrestrial; food chiefly small mammals; mates in July and August; 1 to 4 young born the following April; may breed the second summer, but may not breed until the third summer; young weaned at 6 to 7 weeks (for *M. caurina*).

General. In the forests of the mountains where the marten enjoys protection they are still very common. A. H. Lang saw one that at his approach ran up a tree and sat there, only a few feet from him, scolding a "chep" at intervals until he was tired of watching it and left. Mr. U. U. Lacasse of Banff Park has them come about his dwelling in winter; they take meat from his hand and come into his summer kitchen through a hole in the wall.

Figure 50. Marten paws (from skin).

This was one of the common, important fur bearers when the country was new, and it is still important though much less common. When abundant there were marked cyclic fluctuations in numbers, but these are less evident now; rather the following table shows a progressive decline in the take.

The annual total value of the marten taken in Alberta in the period 1919-20 to 1937-38 has varied between $5,068 and $248,151; the average value per pelt has varied annually from $11.50 (1934-35) to $41.66 (1919-20).

The Alberta marten yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	5,956	1930-31	898
1920-21	4,253	1931-32	614
1921-22	...	1932-33	362
1922-23	4,603	1933-34	533
1923-24	3,568	1934-35	574
1924-25	3,046	1935-36	911
1925-26	3,348	1936-37	625
1926-27	2,069	1937-38	473
1927-28	1,288	1938-39	...
1928-29	1,600	1939-40	...
1929-30	1,033	1940-41	18
		1941-42	...

Reference

Markley and Bassett, 1942: Amer. Midl. Nat., 28, pp. 604-616 (habits in captivity).

Fisher. *Martes pennanti* Erxleben

Diagnosis. Size, male, length about 1,016 mm. (40 in.); tail 406 mm. (16 in.); female smaller; a moderately slender, short-legged tree weasel; colour generally dark brown, grizzled greyish anteriorly; blacker ventrally, on legs and on tail.

Geographical Variation. Skull measurements show that fisher from western Canada are slightly larger than those from eastern Canada, and the following name is used for Alberta animals: *Martes pennanti columbiana* Goldman.

Distribution in Alberta. Formerly northern and western Alberta in the coniferous forests; now scarce in, or unreported from, many areas.

Life History. The 1 to 5 young are born in spring, and the females mate again almost at once; food apparently any small animals, rabbits being one of its favourites; it is well known as an eater of porcupines, and is said to kill, at times, foxes, lynx, and even deer.

General. The heavier coniferous forests, especially in damper areas, seem to be the favourite habitat of this animal. Soper writes that formerly the species was fairly numerous and generally distributed throughout all suitable areas in Wood Buffalo Park, but it had become so scarce that in his 2 years' residence in the park not a single well-supported record of its occurrence came to his notice.

Figure 51. Fisher.

This is one of our fine furs, but the number of fisher taken is so small that it is not now of great importance as a fur bearer. Though the total fisher yield is only a small part of the total fur catch, the value of individual skins is such that a small increase in the number of skins taken would mean a large increase in the value of the catch. The animal is worth strenuous efforts to increase its numbers.

The total annual value of the fisher taken in Alberta in the period 1919-20 to 1938-39 has varied from $18,120 in

1919-20 and $11,460 in 1925-26 to $200 in 1932-33; the annual average value per pelt has varied from $40 to $83.12.

Alberta fisher yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	218	1930-31	17
1920-21	131	1931-32	22
1921-22	...	1932-33	4
1922-23	77	1933-34	21
1923-24	83	1934-35	48
1924-25	78	1935-36	61
1925-26	191	1936-37	37
1926-27	90	1937-38	17
1927-28	52	1938-39	
1928-29	58	1939-40	
1929-30	25	1940-41	
		1941-42	

References

Hall, 1942: Calif. Fish and Game, 18, pp. 143-147 (breeding data).
Rand, 1944: Can. Field-Nat., 58, pp. 77-81 (status).
Soper, 1942: Jour. Mammal., 23, 127 (in Wood Buffalo Park).

Least Weasel. *Mustela rixosa* Bangs

Diagnosis. Male, total length 198 mm. (7·7 in.); tail 32·5 mm.; hind foot 21 mm.; female, total length 188; tail 31·5; hind foot 21 (Saskatchewan specimens); body slender; legs short, tail short; colour in winter, white above and below; in summer brown above, white below, no black tip to tail summer or winter, though a few black hairs are often present in the tip of the tail.

Geographical Variation. Specimens are referable to: *Mustela rixosa rixosa* Bangs.

Distribution in Alberta. The northern and central part of the province; generally rare, but apparently fairly common locally in the park lands.

Life History. Changes colour from brown in summer to white in winter; 4 to 6 young; food, mice, and perhaps many insects.

General. The least weasel is our smallest carnivore. The Criddles, in Manitoba, write that the least weasel is such a midget that it usually passes unnoticed unless caught in a trap. It is apparently an efficient mouser, for

they write of it destroying the inhabitants of nests of meadow mice, and taking possession of the nests. One such nest was occupied by a weasel for about 2 weeks, during which time it was observed that several mice had been carried over the snow to the home. This mouse nest was examined in April, and in it were discovered six dead lesser meadow mice, one red-backed mouse, the head of another, and at least six or eight other remnants, including Drummond meadow mouse, these last remains being indicated chiefly by the hair-lined nest of the weasel.

Figure 52. Upper figure least weasel; middle figure tail of short-tailed weasel; lower figure tail of long-tailed weasel.

The scarcity of this small weasel, its small size, and the lack of a white tip to the tail are all probably reasons for its rarely appearing in the fur trade.

Reference

Criddle, 1925: Can. Field-Nat., 39, p. 142 (habits, Manitoba).

Short-tailed Weasel. *Mustela erminea* Linnaeus

Diagnosis. Total length 291 to 316 mm. (11·4-12·4 in.); tail 85-86 mm. (3·3 in.); hind foot about 40 mm.; varies with the subspecies; female considerably smaller; body slender; legs short; tail cylindrical; seasonally dimorphic; colour in winter all white, sometimes yellowish stained with a black tip to the tail, colour in summer uniform brown above, white below; tail brown tipped with black.

Geographical Variation. The animals from southern Alberta are smaller than those from the northern part of the province, allowing two races to be distinguished:

(1) *Mustela erminea richardsonii* Bonaparte. Male, total length 316 mm., tail 85, hind foot 40 (average three males Wood Buffalo Park, Soper); the northern part of the province.

(2) *Mustela erminea invicta* Hall. Males, total length 291 mm., tail 86, hind foot 39·9 (average ten males, Idaho, original description); female, total length 255, tail 71, hind foot 32·3 (average five females, Idaho, original description); a smaller race with lighter skull; the southern part of the province, north to Red Deer River and the headwaters of Smoky River.

Distribution in Alberta. Recorded as occurring throughout, but probably absent from most of the drier plains of the southeast; apparently cyclic in numbers, very common some years in wooded and semi-wooded country.

Life History. Changes colour from white in winter to brown in summer; mates in summer; 4 to 9 young born the following spring; food chiefly small mammals.

General. Restlessness and abounding energy are keynotes of the weasel's temperament. It is epitomized in the saying "as well try to catch a weasel asleep" in reference to something almost impossible of accomplishment.

Forest, bushland, and adjacent grassland are this weasel's favourite haunts. In northern Alberta Soper estimates that the population may be ten to the square mile in years of plenty. This weasel belongs to the same

species as does the old world ermine, and these are the animals whose white winter pelage with black-tipped tail provides the fur called ermine, the badge of royalty.

The annual total value of the weasel taken from Alberta in the period 1919-20 to 1941-42 has varied between $45,096 and $684,150; the average value per pelt has varied annually from 47 cents (1934-35) to $1.75 (1926-28).

The Alberta weasel yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	68,959	1930-31	119,827
1920-21	85,176	1931-32	262,091
1921-22	.....	1932-33	267,461
1922-23	72,260	1933-34	198,942
1923-24	57,962	1934-35	127,383
1924-25	60,150	1935-36	213,090
1925-26	113,647	1936-37	321,499
1926-27	94,103	1937-38	156,519
1927-28	109,687	1938-39	208,043
1928-29	267,575	1939-40	396,770
1929-30	182,204	1940-41	181,132
		1941-42	526,269

This includes the less numerous and more valuable pelts of the long-tailed weasel.

References

Hall, 1945: Jour. Mammal., 26, pp. 175-182 (taxonomy).
Hamilton, 1933: Amer. Midl. Nat., 14, pp. 289-373 (habits in New York State).
Soper, 1919: Can. Field-Nat., 33, pp. 43-47 (habits in Alberta).

Long-tailed Weasel. *Mustela frenata* Lichtenstein

Diagnosis. Male, total length 450 mm. (17·7 in.); tail 155 mm. (6·1 in.); hind foot 50 mm. (1·9 in.); female, total length 380 mm. (14·9 in.); tail 130 mm.; hind foot 46 mm. (Islay specimens, Soper); body slender, legs short, tail cylindrical, rather long; colour in winter, white above and below, sometimes tinged yellowish, tip of tail black; in summer uniform pale brown above, white below, tail tipped black.

Geographical Variation. Specimens are referable to: *Mustela frenata longicauda* Bonaparte.

Distribution in Alberta. Central and southern Alberta, including the eastern slopes of the Rocky Mountains.

Life History. Colour changes by moult from white in winter to brown in summer, 4 to 8 young born in a nest in some burrow or other shelter, in the spring; food chiefly mammals and birds.

General. The weasels' chosen field is the open prairie, where they wander erratically from place to place, visiting wolf-willow clumps, gopher holes, odd stones, aspen bluffs, and any other irregularities that appear in their line of travel. They are common on the prairie, but their presence, unless searched for, would pass unnoticed until snow comes and their tracks reveal their presence. Soper has spent many hours upon their trails and found these weasels to travel throughout the bitterest weather. Red squirrel and mink suspend their activity during the strong cold, but weasels travel on the coldest and stormiest nights over the bleakest and most exposed ranges. Although their wanderings seem the most erratic and inconsistent imaginable, there is in it a sort of method, and they return again and again over the same route (Soper).

In the plains and edge of the park lands this is probably the most important weasel as a fur bearer, but the fur returns include them with the short-tailed weasel and it is impossible to separate the data.

References

Criddle, 1925: Can. Field-Nat., 39, pp. 142-48 (habits in Manitoba).
Hamilton, 1933: Amer. Midl. Nat., 14, pp. 289-373 (habits and economic status in New York).
Soper, 1919: Can. Field-Nat., 33, pp. 43-47 (habits).
Soper, 1921: Can. Field-Nat., 35, p. 109 (habits at Islay).

Mink. *Mustela vison* Schreber

Diagnosis. Total length 560 mm. (22 in.); tail 190 mm. (7·5 in.); hind foot 67 mm. (2·6 in.) (type of *lacustris*, Preble); body slender, legs short, tail bushy; colour above and below dark brown, with a white area on throat.

Geographical Variation. The mink of Alberta have been variously listed as *Mustela vison energumenos* Bangs, *Mustela vison vison* Schreber, and *Mustela vison lacustris* Preble. Anderson lists them all as: *Mustela vison lacustris* Preble, to which the above measurements apply.

Distribution in Alberta. Northern and western part of the province.

Life History. Five or 6 (rarely 2 to 10) young born in spring after a gestation period of about 42 to 76 days; food small mammals, birds, fish, frogs, and crustaceans.

General. The mink is common in some parts of its range, rare in others. Swamps and watercourses are its favourite haunts, and there it leads its amphibious existence. In winter, along the shore of streams and lakes below the ice an air space usually occurs, caused by the subsidence of the water from an earlier winter level when the ice formed. Here the mink prowls and feeds during the bitter cold (Soper).

Figure 53. Mink.

In summer it is sometimes seen by travellers along the waterways, and it may be amazingly bold as the following account from Preble's experience in the Mackenzie district shows. "While making a portage to avoid a rapid

I caught several large lake trout in the eddy at its foot. These I tossed among the boulders on the shore as fast as I secured them. On gathering the fish I missed one, and after a short search found it partially hidden beneath a boulder where it had been dragged by a mink which was still engaged with it. I set a small steel trap and while holding it by the chain with one hand I seized the fish by the tail and gently led the mink into the trap."

Mink pelts have long been one of the staple furs.

The total annual value of the mink taken from Alberta in the period 1919-20 to 1942-43 has varied between $19,636 and $1,723,531.95; the average value per pelt has varied annually from $3.58 (1931-32) to $15 (1926-29).

The Alberta mink yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	9,948	1931-32	5,485
1920-21	8,943	1932-33	8,559
1921-22	....	1933-34	9,377
1922-23	14,963	1934-35	9,274
1923-24	20,294	1935-36	12,145
1924-25	11,928	1936-37	11,367
1925-26	7,104	1937-38	13,893
1926-27	2,234	1938-39	30,219
1927-28	1,708	1939-40	59,788
1928-29	2,672	1940-41	74,970
1929-30	2,457	1941-42	76,090
1930-31	3,235	1942-43	134,127

The above figures evidently include both ranch raised and wild caught mink. Mink have proved to be one of the few wild fur bearers that can be successfully ranched. In Alberta the number of mink ranches has increased steadily from 35 in 1929 to 773 in 1943, with 86 additional ranches raising both mink and foxes. The pelt production from mink ranches was 250 pelts in 1929; in 1943 it was 106,179, with a total value of $1,152,042.15.

References

Sealander, J. A., 1943: Jour. Wildlife Manag., 7, pp. 411-417 (winter food in Michigan; muskrat most important individual prey, cottontail second, meadow mouse, third).

Soper, 1942: Jour. Mammal., 23, pp. 128, 129.

Black-footed Ferret. *Mustela nigripes* Audubon and Bachman

Diagnosis. Male, total length 512 mm. (20 in.); tail 120 mm. (4·7 in.); hind foot 58 mm. (Saskatchewan specimens); body fairly slender; legs short; tail moderate, cylindrical; colour above generally yellowish white with many guard hairs tipped with yellowish brown; centre of back more brownish; a band across eyes, feet, and legs, and tip of tail black; underparts white.

Figure 54. Black-footed ferret.

Geographical Variation. No subspecies are recognizable, so the species is known by the binomial: *Mustela nigripes* Audubon and Bachman.

Distribution in Alberta. The southern plains.

Life History. Little known; said to be closely associated with prairie dogs, which are thought to be their main food.

General. Throughout its range the black-footed ferret is usually recorded as seen in or about prairie dog "towns", as the colonies are called. As prairie dogs are absent from Alberta, the occurrence of this weasel may be looked on as accidental.

Reference

Bailey, 1926: No. Amer. Fauna, No. 49, pp. 171, 172 (general).

Subfamily—Guloninae. Wolverines

This subfamily, not recognized by many authors but included with the Mustelinae, has a northern distribution in the boreal forests of both the old and the new world. A number of species have been described, all apparently closely related if not conspecific.

Only one form occurs in Alberta.

Wolverine. *Gulo luscus* Linnaeus

Diagnosis. Male, total length up to 1,070 mm. (42·1 in.); tail 218 mm. (8·6 in.); hind foot 190 mm. (7·5 in.); weight 36 pounds (a large male from Alaska, Bailey); body stout and short; legs short; tail short and bushy; colour variable from brown to nearly black above, usually with a broad yellow or yellowish stripe along each side, meeting over hips; shoulders yellowish; crown grey, extremities black; underparts dark brown with white or yellowish on throat and chest.

Geographical Variation. The population is referred to the following subspecies: *Gulo luscus luscus* Linnaeus.

Distribution in Alberta. The forests of the north, and the mountains of the west.

Life History. Two to 5 young born in some sheltered cavity; gestation period reported as 60 days by earlier writers, up to 183 days by later ones; food small and large animals, including occasionally moose and caribou; carrion; it frequently robs caches and trap-lines; captives may live to 15 years of age, but average length of life in captivity is 5½ years.

General. The wolverine has by tradition become a symbol of destructiveness, and is widely execrated as a robber of trap-lines and a despoiler of caches and cabins. Anderson writes that the Indians and Eskimo and most white men residing in the north generally come to look upon a certain amount of depredation by wolverines as unpreventable, fated, and like the annoyance of mosquitoes taken as a matter of course.

Though sometimes included with species that are considered in danger of extermination, the wolverine is fairly common over a wide range in Canada and is in no immediate danger of extermination.

As a fur producer in Alberta the wolverine is not important because of the small catch.

Figure 55. Wolverine.

The annual total value of the wolverine taken from Alberta in the period 1919-20 to 1941-42 has varied between $22 and $5,640; the average value per pelt has varied annually from $2 (1933-34) to $20 (1927-30).

The Alberta wolverine yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	101	1930-31	19
1920-21	107	1931-32	6
1921-22	...	1932-33	14
1922-23	123	1933-34	11
1923-24	220	1934-35	69
1924-25	255	1935-36	35
1925-26	203	1936-37	17
1926-27	354	1937-38	20
1927-28	66	1938-39	31
1928-29	282	1939-40	25
1929-30	32	1940-41	26
		1941-42	14

References

Anderson, 1913: in Stefansson's "My Life with the Eskimo" (general).
Henderson and Craig, 1932: Economic Mammalogy (food).

Kenneth, 1943: Gestation Periods.
Seton, 1929: Lives of Game Animals (general).
Wood, 1944: Amer. Midl. Nat., 31, p. 505 (age reached in captivity).

Subfamily—Lutrinae. Otters

The otters are adapted for an aquatic existence, and are expert at swimming and diving, catching fish in their native element. Their distribution is widespread over the Americas, Europe, Asia, and Africa. Otters have been tamed, and make excellent pets. In the Orient they are tamed and used in driving fish into nets, and also to swim and catch fish for their masters.

Only one species occurs in Canada.

Otter. *Lutra canadensis* Schreber

Diagnosis. Length up to 1,220 mm. (48 in.); tail 482 mm. (19 in.); weight estimated at 25 pounds; female somewhat smaller (Bailey for *L.c. canadensis*); body slender; tail strong and tapering; legs short; fur short, dense; colour dark brown, paler below, with greyish buff on cheeks and throat.

Figure 56. Otter.

Geographical Variation. Otter from Alberta have been referred to *L.c. canadensis* and *L.c. preblei*, but only the following subspecies is recorded for Alberta by Anderson: *Lutra canadensis preblei* Goldman. However, specimens from the southern part of the province may prove to represent a different, southern race.

Distribution in Alberta. Rare in the north; of doubtful occurrence in the south.

Life History. Two to 4 young born in the spring after a 49- to 62-day gestation period; food usually fish and other aquatic animals, also small mammals and birds.

General. From the adjacent Mackenzie district Preble writes of otter: when pursued they swam together beneath the surface, rising at intervals to breathe and reconnoitre. On first reaching the surface the animal raises its head about a foot above the water to survey the situation. After remaining a few seconds in this position it sinks until only the head remains in sight while it regains its breath, remaining quiescent for some seconds. It then dives again, especially if hard pressed, and swims for a distance of 200 yards or more before reappearing, usually in an unexpected direction. If the animal is wounded it raises only the nose above the surface and in this position usually escapes detection if there be ever so slight a ripple on the water.

Though otters are most at home in the water they come ashore to eat their prey, spend considerable time on the stream banks, and make long trips overland from waterway to waterway.

The annual total value of the otter taken from Alberta in the period 1919-20 to 1941-42 has varied between $1,200 and $9,175; the average annual value per pelt has varied from $10.62 (1937-38) to $30 (1927-30).

The Alberta otter yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	288	1930-31	193
1920-21	392	1931-32	140
1921-22	...	1932-33	156
1922-23	264	1933-34	100
1923-24	367	1934-35	98
1924-25	352	1935-36	151
1925-26	270	1936-37	178
1926-27	206	1937-38	207
1927-28	149	1938-39	198
1928-29	229	1939-40	199
1929-30	145	1940-41	124
		1941-42	99

References

Bailey, 1926: No. Amer. Fauna, No. 45 (general).
Kenneth, 1943: Gestation Periods.
Preble, 1908: No. Amer. Fauna, No. 27, pp. 228, 229 (in Athabaska-Mackenzie area).
Seton, 1929: Lives of Game Animals (general).

Subfamily—Mephitinae. Skunks

This is a strictly American group occurring only in North and South America. Its members are notorious for the strong-smelling fluid that is secreted by a pair of anal glands. This secretion can be sprayed at will and is used as a weapon of defence. The odour is such that the skunk has become proverbial, though many others of the weasel family have a similar odour, and in some it appears to be nearly as powerful.

The skunks are terrestrial animals that have their front claws modified for digging. They are slow moving animals, and feed on a variety of animal and vegetable food, including many insects.

Only one species occurs in Alberta.

Skunk. *Mephitis mephitis* Schreber

Diagnosis. Total length 660 mm. (25·9 in.); tail 250 mm. (9·8 in.); hind foot 88 (a Wood Buffalo Park male, Soper); body stout, tail long and bushy; colour generally black, with a white patch on nape and from this, extending down each side of the back, a white stripe of varying width; tail usually white and black. In eastern Canada skunks with little white on them are not uncommon, but are rare or absent in Alberta.

Geographical Variation. Alberta specimens are referable to: *Mephitis mephitis hudsonica* Richardson, though there are some discrepancies (Crowe).

Distribution in Alberta. Common from the southern border to Wood Buffalo Park.

Life History. Hibernates in burrows in winter; 2 to 10 (usually 6 to 8) young born in spring a 42- to 63-day gestation period; food chiefly insects, mice, and berries; refuse is relished.

General. The skunk is an adaptable creature, common in the forests of Wood Buffalo Park and on the arid plains near Milk River. It sleeps in its burrow during the day and at dusk sallies forth. Where garbage is available and the skunks protected as at Waterton Lakes they gather nightly to feed, paying little attention to watching humans. Undisturbed they walk or trot slowly; hurried they gallop clumsily with tail drooping, but when alarmed the tail goes up like a warning plume and the skunk prepares to spray the strong-smelling liquid from its anal glands that is its chief defence. Sometimes it will make a short dash toward an intruder or stamp its feet, perhaps as an additional warning, but it is usually loathe to discharge its weapons, unless injured.

Figure 57. Skunk.

The annual total value of the skunk taken from Alberta in the period 1919-20 to 1941-42 has varied between $4,398 and $89,826; the average value per pelt has varied annually from 60 cents (1932-33) to $3.41 (1919-20).

The Alberta skunk yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	3,323	1930-31	6,673
1920-21	3,462	1931-32	4,887
1921-22	....	1932-33	8,865
1922-23	7,439	1933-34	27,163
1923-24	7,733	1934-35	20,343
1924-25	6,470	1935-36	13,334
1925-26	5,795	1936-37	23,769
1926-27	3,875	1937-38	12,744
1927-28	3,567	1938-39	14,710
1928-29	6,985	1939-40	27,452
1929-30	6,278	1940-41	17,513
		1941-42	33,269

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 396 (taxonomy).
Hall, 1936: Carnegie Hist. Wash. Pub., No. 473. pp. 41-119 (taxonomy).
Soper, 1942: Jour. Mammal., 23, pp. 129, 130 (Wood Buffalo Park).

Subfamily—Taxidinae. American Badgers

Though with very heavy, fossorial claws on the front feet, the badger spends much of its time on the surface of the ground. The badgers of the old world, though similar in external appearance and general habits to those of the new world, are put in a separate subfamily on anatomical grounds.

Only one species occurs in Canada.

Badger. *Taxidea taxus* Schreber

Diagnosis. Total length 880 mm. (34·6 in.); tail 150 mm. (4·52 in.); hind foot 110 mm. (7·4 in.) (Alberta specimen); body stout, flat; legs short; front claws very long and heavy; tail short; colour above grizzled grey, more rusty posteriorly; muzzle to top of head brown or blackish divided by a median white stripe that continues back to the shoulders; side of head white with a blackish mark on each side of the head (Figure 58); underparts white or whitish.

Geographical Variation. The Alberta form is the nominate subspecies: *Taxidea taxus taxus* Schreber.

Distribution in Alberta. Common on the southern plains and into the edge of the mountains; north rarely to the Athabaska.

Life History. Young born in a burrow made by the badger, after a gestation period of about 183 days; food small mammals, especially ground squirrels.

General. The plains and grasslands of the south are the badger's home. Often it is abroad by day, secure in its bulk and its strength from most diurnal enemies. On short legs it travels at a trot, faster than a man's walk, and it gives the impression of being on definite business. Its squat, flat body, close to the ground, seems to flow along with a succession of ripples passing from nose to tail. If pursued it may gallop; if pressed it may take refuge in one of the burrows that always seem at hand. If one looks into the burrow after it, like as not he will find the striped face of the badger peering out at him, to be hurriedly withdrawn and then, if the burrow is shallow, jets of dirt come spurting out as the badger digs deeper, working for safety. Then if one retires and watches from a little distance, in a few moments the badger's head appears and shortly the animal comes out again and sets off at a jog-trot over the plains.

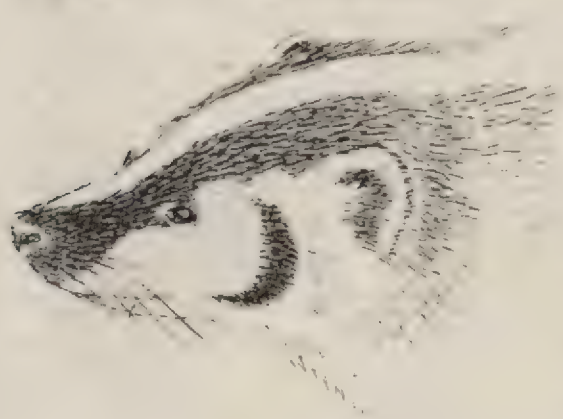

Figure 58. Badger head.

Where there are badgers the burrows they have made are common, for these animals feed on ground squirrels, which they get by digging down after them. On the plains it is the Richardson ground squirrel; in the woodlands it is the Columbian ground squirrel. In the edge of the mountains near Banff where ground squirrels are common in some valleys, badgers may move in, raise a family, and nearly extirpate the local ground squirrel population. With the ground squirrels gone the badger moves on and for a season or two the little valley may remain untenanted by badgers until the ground squirrel

population increases again. In the bushlands and long grass country riders dislike the badgers for there the burrows are not easily seen and horses step into them and riders are thrown. Out in the short grass plains country where the burrows are easily seen and avoided, riders give them little thought.

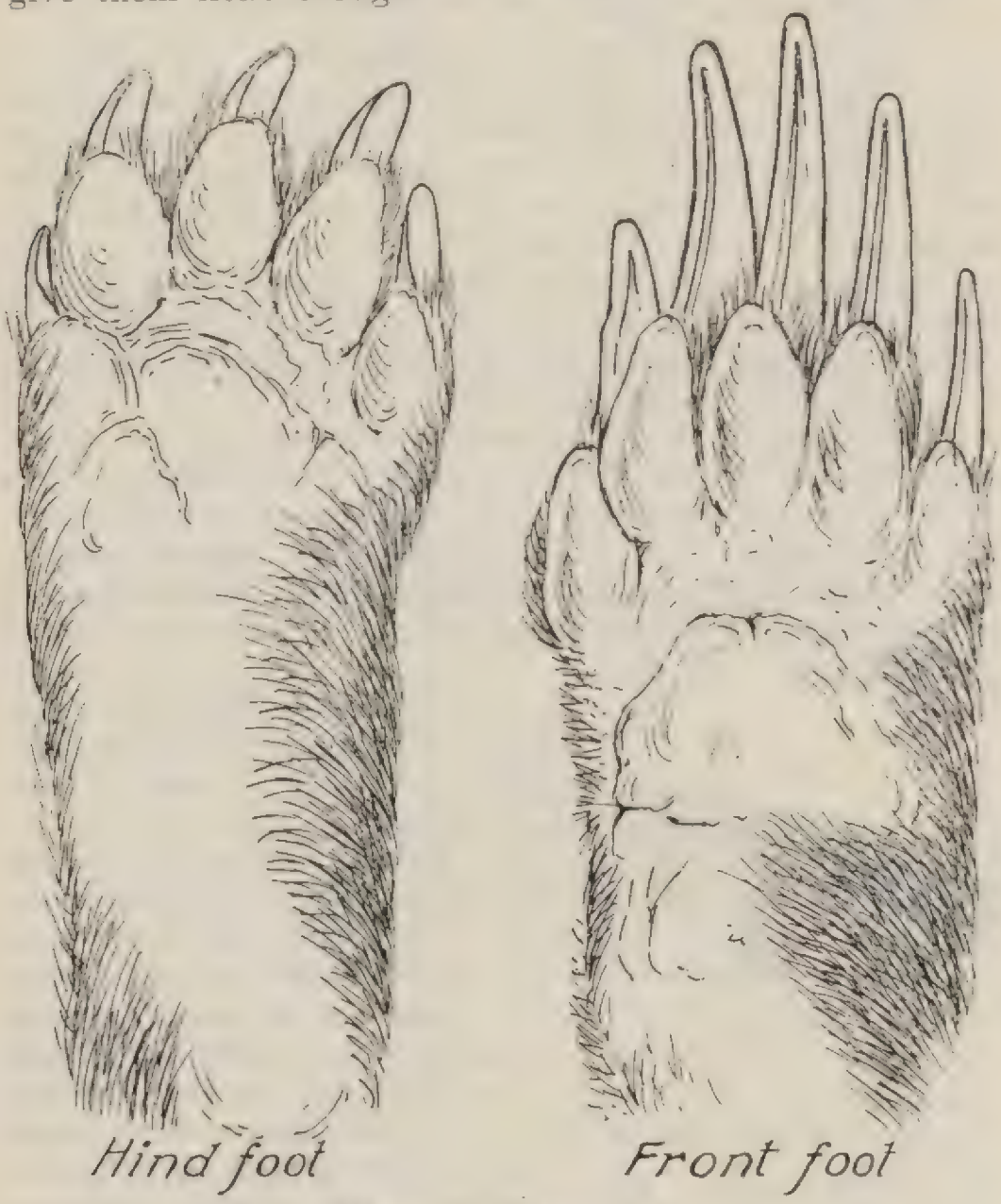

Figure 59. Badger feet.

Thus the attitude toward the badger varies. In parts of Alberta it has been treated as vermin. In parts it is accorded protection as a fur bearer. Over much of the

plains it is one of the few fur bearers that, along with the long-tailed weasel, the skunk, coyote, and jack rabbit, yield their pelts to the part-time trapper.

The total annual value of the badger taken from Alberta in the period 1922-23 to 1941-42 has varied between $311 and $384,252; the average annual value per pelt has varied from 92 cents (1920-21) to $22 (1936-37).

The Alberta yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	761	1930-31	3,689
1920-21	219	1931-32	2,253
1921-22	...	1932-33	1,068
1922-23	1,102	1933-34	1,320
1923-24	1,778	1934-35	1,101
1924-25	3,008	1935-36	130
1925-26	5,588	1936-37	35
1926-27	10,582	1937-38	76
1927-28	15,919	1938-39	58
1928-29	17,466	1939-40	89
1929-30	6,063	1940-41	3,150
		1941-42	5,004

FAMILY—CANIDAE. DOGS AND THEIR RELATIVES

The dog family, which includes the foxes, wolves, coyotes, jackals, etc., has a cosmopolitan distribution, though in some areas, such as Australia, the wild dog or dingo may owe its presence to early human introduction.

In Canada there are represented four genera and six species, of which three genera and five species occur in Alberta. These wolves and foxes are cursorial animals, carnivorous in diet, largely nocturnal, but often abroad by day; the young are born in a helpless condition in some burrow, and usually both male and female bring them food for some time before they leave the nest and hunt in a pack with the parents.

Colour phases are common in the wolf, the red fox, and the arctic fox, and are so different in some cases that they have received different vernacular names.

Some of the northern species, such as the timber wolf and the arctic fox, occur in both the Old and the New World, and the red fox of the Old and the New World are so similar that it has been suggested that they are probably the same species, though usually kept separate.

The domestic dog, though most closely related to the timber wolf, still has its exact origin clouded in obscurity. Probably it was in Asia.

Reference

Allen, 1919-1920: Mus. Comp. Zool., Bull. 63, pp. 431-517 (Dogs of the American Aborigines).

KEY TO SPECIES

(1) Tail with distinct white tip—red fox (*Vulpes fulva*)
(1a) Tail without sharply defined white tip 2
(2) Size small, total length less than 900 mm. (35·4 in.)..... 3
(2a) Size larger, total length more than 1,000 mm. (39·36) .. 4
(3) Pelage grizzled, tip of tail black—kit fox (*Vulpes velox*)
(3a) Pelage uniform, white or smoky grey—arctic fox (*Alopex lagopus*)
(4) Total length 1,300 mm. (51·1 in.) or less—coyote (*Canis latrans*)
(4a) Total length 1,500 mm. (59 in.) or more—wolf (*Canis lupus*)

Red Fox. *Vulpes fulva* Desmarest

(Coloured Fox, Silver Fox, Black Fox, Cross Fox)

Diagnosis. Total length 1,015-1,125 mm. (40-44 in.); tail 420-461 mm. (16·5-18·1 in.); hind foot 170-195 mm. (6·6-7·6 in.); female slightly smaller than male; slender, dog-like, with a big bushy tail, especially in winter; colour varies greatly, generally yellowish red with backs of ears and ankles black and tip of tail white. Four main types or colour phases are usually recognized, and in the fur trade are given different names: red fox, pelage generally yellowish red; cross (or patch) fox, generally yellowish, but with black in the pelage tending to form a cross-shape mark or patch on the shoulder (hence the name); silver fox, generally black with many silver-tipped hairs; and black fox, with pelage generally black. However, examination of large series of skins has shown that there is intergradation between the extreme conditions, and there are specimens that it is difficult to assign to one or another colour phase. Three colour phases, red, cross, and silver, have been seen in one litter. In addition, various other

"varieties" have been developed on fur farms, including the platinums and various white-spotted phases. The Samson fox is a freak, in which the guard hairs are lacking.

Figure 60. Coloured or red fox.

Geographical Variation. Bailey considers all the red foxes of North America to belong to one species, and this is possibly conspecific with the Old World red fox. In Alberta the following subspecies are recorded.

(1) *Vulpes fulva macroura* Baird. Total length 1,015 mm., tail 461; hind foot 172 (Bailey, 1936); a large, long-tailed, light yellow fox. Occurs in the west, in the Rocky Mountains.

(2) *Vulpes fulva abietorum* Merriam. Male, total length 1,125 mm., tail 440; hind foot 195 (Wood Buffalo Park, Soper); with a light slender skull. It occurs in northwest Alberta.

(3) *Vulpes fulva regalis* Merriam. Total length 1,117 mm., tail 420; hind foot 170 (type, Bailey 1926); a large red fox, with long tail, large ears, golden-yellow colour paler on rump and face; much black on legs and tail. Occurs in eastern Alberta.

Distribution in Alberta. Widespread throughout, but very rare on the southern plains.

Life History. The 3 to 9 young, born in spring after a 48- to 56-day gestation period, remain in and about the

den until midsummer, being cared for by both parents; the staple food is probably small mammals in which mice, ground squirrels, and rabbits predominate, but many other items such as birds and fruit are eaten.

General. The fox is an agile, graceful creature with a cunning that has given it a place in folklore.

Soper writes that in Wood Buffalo Park it is one of the commonest mammals, and ranging everywhere, occurs in astonishing numbers in peak years. Several trappers, single handed, took from 75 to more than 100 pelts in the season of 1932, and 1933 was a peak year. Indians told Soper that foxes were especially numerous where migrant barren-ground caribou were common. It is said that foxes visit the kills made by timber wolves to eat the remains left by the wolves.

Foxes have periods of plenty, and periods of scarcity. There have been attempts to show that these correlate into widespread cycles, but there is some evidence to show that these fluctuations are local in extent, and not synchronized over a wide area. MacFarlane has pointed out that in the Northwest Territories the fur return has been cyclic in the latter part of the last century, and the table given below of recently taken furs also shows pronounced variation.

The annual total value of the red fox (red phase) taken from Alberta (presumably mostly wild caught) in the period 1919-20 to 1941-42 has varied between $10,557 and $212,760; the annual average value per pelt has varied from $5.52 (1939-40) to $30 (1927-30).

The Alberta red fox yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	477	1930-31	2,411
1920-21	1,308	1931-32	4,047
1921-22	....	1932-33	7,310
1922-23	6,083	1933-34	13,395
1923-24	11,511	1934-35	13,908
1924-25	14,184	1935-36	7,616
1925-26	11,835	1936-37	2,490
1926-27	5,085	1937-38	1,371
1927-28	1,330	1938-39	1,776
1928-29	1,545	1939-40	3,105
1929-30	1,474	1940-41	5,248
		1941-42	14,789

MacFarlane writing of the 20-year period 1858-77 says that the Athabaskan district contributed 6,582 red, 4,652 cross, and 1,450 silver fox pelts. No recent data is available on the frequency of the various colour phases in the wild.

The silver fox was at one time extremely costly as a pelt, and this led to growing them in captivity. Now the silver fox pelts marketed in Alberta (presumably mostly from farms) exceed the red fox pelts (presumably mostly wild taken) in number. In the period 1932-1942 the number of silver fox pelts produced annually in Alberta varied from 9,942 to 26,142, and in total value from $198,840 to $482,408. With the production of a ranch-raised supply the early high price has dropped. In 1920 the average value was $193.38 per skin; by 1930 it had dropped to $75; and in the 10 years 1932-1942 the average annual value has varied from $11.57 to $34 a skin.

References

Bailey, 1936: Nature Magazine, vol. 28, pp. 269-272, 317 (list of subspecies).
Cross, 1940: Jour. Mammal., 21, pp. 294-306 (fluctuations in Ontario).
Cross, 1941: Jour. Mammal., 22, pp. 25-39 (colour phases).
MacFarlane, 1905: Proc. U.S. Nat. Mus., 28, pp. 703, 704 (fluctuations and colour phases).
Merriam, 1900: Proc. Wash. Acad. Sci., 2, pp. 661-676 (revision).
Soper, 1942: Jour. Mammal., 23, p. 130 (Wood Buffalo Park).

Kit Fox. *Vulpes velox* Say
(Also called Prairie Fox)

Diagnosis. Total length 844 mm. (33 in.); tail 312 mm. (12 in.); hind foot 130 mm. (5·1 in.) (type of *hebes*). A very small fox, above dark yellowish grey, grizzled, sides brighter; legs and underparts buffy; tip of tail and sides of nose black; fur long in winter, short in summer.

Geographical Variation. The Alberta animals are referable to: *Vulpes velox hebes* Merriam.

Distribution in Alberta. The southern plains; once common, now almost extinct.

Life History. Five young, born in a den in spring (Seton); food, probably small mammals and insects.

General. The story heard from the older plainsmen is the same all over southern Alberta; 20 to 30 years ago or more these little foxes were common. When the cattle men were camped out on the round-up, the bold, mischievous, little animals used to come into camps at night and chew up straps and saddlery.

Now they are practically gone. Probably the campaign with poison against wolves and coyotes had a great effect on these bold, unsuspicious animals. Bailey, writing of North Dakota, says they were very easily trapped, poisoned, or caught by dogs, so that they did not last long after the country became settled.

The kit fox used to supply some pelts to the fur trade. MacFarlane writes that in the period 1853-1877 the Hudson's Bay Company sold in London 117,025 pelts. Seton records that at Lampson sales in London, in March 1906, 1,404 pelts were sold, at prices ranging from about 30 cents to $1.32. No kit foxes are listed in recent fur returns, though Seton assumes that "fox, other" is equivalent to kit fox.

Any information on the occurrence of kit foxes is worthy of record, and any specimens should find their way to a Museum, but it must be kept in mind that a fox kit (= a young fox) is not necessarily a kit fox.

References

Bailey, 1926: No. Amer. Fauna, No. 49, pp. 164, 165 (habits and status, North Dakota).
Fowler, 1937: Can. Field-Nat., 51, pp. 15, 16 (former occurrence at High River).
MacFarlane, 1905: Proc. U.S. Nat. Mus., 28, p. 704 (fur data).
Seton, 1929: Lives of Game Animals (general).

Arctic Fox. *Alopex lagopus* Linnaeus

(The white colour phase is called White Fox; the blue colour phase Blue Fox)

Diagnosis. Total length 845 mm. (33 in.); tail 320 mm. (12·5 in.); hind foot 136 mm. (5·4 in.) (Mackenzie specimen). A rather small fox; muzzle rather blunt, ears small, pelage long in winter, soles of feet well furred; in summer pelage rather greyish or sooty brown, paler below; in winter pelage usually pure white, but in the

Canadian arctic a "blue" colour phase in which the pelage is generally smoky grey is occasionally found. The proportion of blue foxes varies locally in Canada, but is usually less than 2 per cent.

Geographical Variation. The subspecies of this circumpolar species represented in Alberta is *Alopex lagopus innuitus* Merriam.

Distribution in Alberta. Wanders from the barren grounds into the northeast corner sporadically in winter (Soper).

Life History. Young up to 10 (or 20?) in number born in a burrow, after gestation period of about 60 days; food, small mammals, birds and their eggs, fish, berries, and the leavings of wolf and polar bear kills.

General. The arctic tundra and the coasts of the Arctic Ocean are the normal home of this fox. But in the years of plenty, when these foxes become very numerous, they spread southward during the winter, and then some penetrate into the coniferous forests, and they have been taken as far south as Athabaska.

Reference

Soper, 1942: Jour. Mammal., 23, p. 131 (occurrence in Alberta).

Coyote. *Canis latrans* Say

Diagnosis. Total length 1,072-1,219 mm. (42·1-48·2 in.); tail 255-394 mm. (10-15·5 in.); hind foot 178-200 mm. (7-7·8 in.); generally wolf-like in appearance, but smaller, with larger ears and more slender muzzle; colour similar to that of some grey wolves; above mixed buffy, grey, and black; below whitish, ears fulvous to buffy; tail with small black tip.

Bailey writes that in distinguishing a coyote from a wolf the nose, foot, and tooth measurements are sufficient. In the coyote the nose pad measures approximately $\frac{7}{8}$ inch wide; the heel pad of front foot 1 inch wide, and the greatest diameter of the canine tooth at base 0·3 inch.

Geographical Variation. In Alberta the following four subspecies are represented.

(1) *Canis latrans latrans* Say. Size large, total length 1,219 mm., tail 394, hind foot 179; skull, basal length 190, zygomatic breadth 109 (Merriam); in the parklands of central Alberta.

(2) *Canis latrans lestes* Merriam. Size large, next to *latrans;* total length 1,116 mm., tail 320, hind foot 200; in colour almost like *latrans*, but slightly paler and skull and teeth smaller; skull, basal length 170, zygomatic breadth 102 (Merriam); in Rocky Mountains of the west.

(3) *Canis latrans nebrascensis* Merriam. Similar to *lestes*, but paler; backs of ears buff instead of fulvous; skull, basal length 177 mm., zygomatic breadth 100 (Merriam); in the plains of the south.

(4) *Canis latrans incolatus* Hall. A medium-sized coyote, total length 1,099, 1,072 mm., tail 255, 307; hind foot 181, 178 (2 females, type locality); differs from the above races in being more cinnamon, in having less of black and white markings, and without black on the forelegs (Hall).

Distribution in Alberta. General; it is said that coyotes have increased considerably in abundance in the north in the last 40 years.

Life History. Mostly nocturnal, but also abroad by day; 1 to 14 (average about 6) young, born in the spring after a gestation period of 60 to 64 days, in a burrow excavated by the animals; young cared for by both parents for some time; food, rabbits, mice, or other small mammals, birds, their eggs, carrion, occasionally larger animals (deer, antelope), live stock, and some vegetable matter.

General. Frequently on the plains the coyote is seen abroad by day, hunting mice or stalking ground squirrels. It has a special technique for catching field mice. Walking cautiously through the grass, the coyote locates a mouse, perhaps by sound or scent. A few cautious steps to get nearer, and then a bound, and the coyote lands with both front feet on the place where he thought the mouse was. A pause, for perhaps the mouse has escaped the first bound; perhaps it is still scurrying through the grass and another bound is necessary. Murie has pointed out this habit is instinctive, and captive pups that have never seen a mouse will go through this behaviour pattern as play.

Sometimes during the day, but more often at night, the coyotes chorus of yelps and howls is heard, the eerie thrilling voice of the west.

The coyote is considered a predator whose numbers should be curbed, and bounties have been put into effect in Alberta. In the early part of the year 1943 numerous complaints were received by the Alberta Government from sheep raisers that coyotes had increased to such an extent as to be a nuisance to the lamb crop. A bounty of $5 (paid in part by the province under certain conditions) was put into effect, and in the period April 1, 1943, to March 31, 1944, bounties were paid on 4,554 coyotes. Most of these pelts were said to have been worthless summer skins.

The coyote is a fur bearer of some importance, and any policy must always consider that, but the coyote has survived under settlement, increased its range despite persecution, and seems well able to care for itself.

The total annual value of the coyote take from Alberta in the period 1919-20 to 1941-42 has varied annually between $38,803 and $504,180; the average value per pelt has varied annually from $5 (1934-35) to $18 (1928-29).

The Alberta coyote yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	8,881	1930-31	10,486
1920-21	5,904	1931-32	10,999
1921-22	.....	1932-33	11,644
1922-23	14,122	1933-34	15,556
1923-24	32,315	1934-35	28,476
1924-25	42,665	1935-36	27,541
1925-26	56,639	1936-37	25,276
1926-27	42,015	1937-38	19,464
1927-28	20,150	1938-39	15,919
1928-29	24,315	1939-40	15,259
1929-30	14,871	1940-41	13,786
		1941-42	18,763

References

Criddle, N. and S., 1923: Can. Field-Nat., 37, pp. 41-45 (habits in Manitoba).

Criddle, 1925: Dom. of Can. Dept. Agr. Bull. (N.S.) 13 (habits and economic status in Canada).

Goldman, 1930: Jour. Mammal., 11, pp. 325-334 (as a predator, and the supposed invasion of the northwest).

Merriam, 1897: Proc. Biol. Soc. Wash., 11, pp. 19-33.
Murie, 1945: Jour. Mammal., 26, pp. 33-40 (food in Montana and British Columbia).
Soper, 1942: Jour. Mammal., 23, p. 131 (in Wood Buffalo Park).

Wolf. *Canis lupus* Linnaeus

(Also called Timber Wolf; Plains Wolf)

Diagnosis. A big, dog-like animal; total length 1,600 to 1,956 mm. (62·9-76·9 in.); tail 370-458 mm. (14·5-18 in.); hind foot 240-295 mm. (9·4-11·6 in.); weight about 100 pounds for large males; colour variable, in the normal grey phase, upperparts greyish, grizzled with brownish and black; ears tipped black; tail like back but with a black spot over tail gland, and tip black; some individuals are nearly pure black, some nearly pure white. Some wolves are very similar in external appearance to some dogs, and occasionally dogs, perhaps with wolf blood in them, are almost indistinguishable. In general the wolf is lankier and has longer legs than the average sledge dog. Its chest is narrower so that the front legs are much closer together than in the dog (Murie); tail always held low.

Geographical Variation. Many subspecies of this circumpolar species have been described, and the following apparently lightly defined subspecies are mapped by Anderson as including parts of the Alberta wolf population.

(1) *Canis lupus occidentalis* Richardson. Total length 1,690, 1,620 mm.; tail 430, 410; hind foot 295, 290 (one male adult, one female adult, Wood Buffalo Park, Goldman); skull, greatest length 269·0 mm.; zygomatic breadth 148·5 (average, 5 males, Wood Buffalo Park, Anderson). Prevailing colour white mixed to a limited but varying extent with black or grey (Goldman); the northern part of the province.

(2) *Canis lupus knightii* Anderson. Total length 1,956 mm.; tail 458; height at shoulder 864; weight 93 pounds (an adult male, Saskatchewan, Anderson); skull, greatest length 282·2; zygomatic breadth 147 (average 3 Saskatchewan specimens, Anderson); apparently similar to *occidentalis* in colour but with slightly larger skull and differing in other cranial characters; the central eastern part of the province.

(3) *Canis lupus irremotus* Goldman. Total length 1,870 mm.; tail 410; hind foot 240 (type, Goldman); skull, greatest length 242·2; zygomatic breadth 128·0 (Waterton Lake, male, Anderson); a light-coloured subspecies differing from the preceding races in the smaller size of the skull and in skull details; the southern plains (now largely exterminated).

(4) *Canis lupus columbianus* Goldman. Total length 1,600 mm.; tail 370 (female, Goldman); skull, greatest length 282; zygomatic breadth 152 (Jasper Park male, Anderson).

Approaches *occidentalis* in large size, but less uniformly greyish or whitish; apparently differs from the above three races in average darker coloration; from *irremotus* in larger size, and in skull details; the Rocky Mountains about Jasper and northward.

Figure 61. Wolf.

Distribution in Alberta. Formerly generally distributed, but now practically exterminated in the southern, more settled areas; still common in the north, and in the mountains from Jasper north.

Life History. Five to 14 young (average about 7) born after a gestation period of 60 to 63 days; young usually cared for by both parents, in an excavated den, but sometimes in a surface bed in dense forest; food, moose, bison, sheep, caribou, rabbits, and almost any other mammal or bird of the region; kills stock; also eats carrion and garbage.

General. The howl of the timber wolf and the call of the loon are two sounds that truly belong to the remote wilderness, a sure indication that one has passed beyond the area where man is in control.

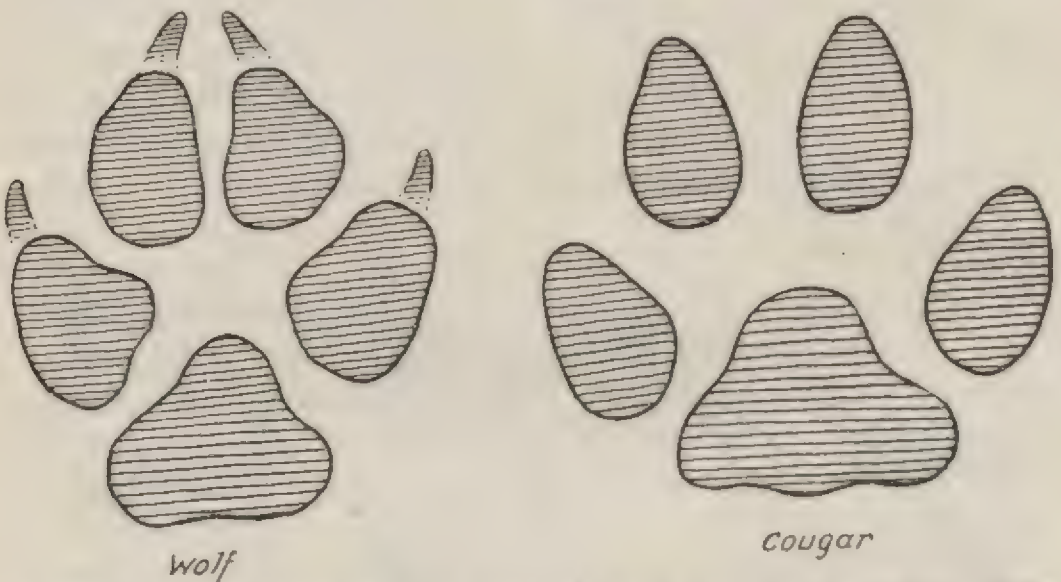

Figure 62. Diagram of hind foot of wolf (left) and cougar (from skins) showing differences observable in tracks.

The wolf is usually considered a villain the bear a clown, despite the fact that bears do real and assessable damage. The prejudices are probably from the time when we heard stories such as that of Goldilocks and the three bears, when the bears were likable characters, and such old world stories as children being thrown from wolf-pursued sleighs to delay the wolf pack while it devours this offering, and allows the sleigh and driver to escape.

The wolf is a predator, fitted to kill big game. This it does. In the stock-raising country where the wolf came

into contact with cattle, the wolf had to disappear, and this happened in southern Alberta in the early part of the century.

But in the wilderness it is a different question. Should we eliminate the wolf if we could? There are areas where predation has been eliminated and big game has increased so that it ate the available food and starved or had to be slaughtered. There is the classical argument that wolves, by preying on the weak and unfit, benefit the species concerned.

The wolf is often blamed for many things it does not do. It is sometimes blamed for the decrease of game in areas in which game has been shot out; it is sometimes blamed for the general decrease of fur, a decrease obviously due to something else.

In summer single wolves or small bands of them may be seen, but in autumn and winter larger bands up to 20 or 25 are not uncommon. These packs are probably composed of two or more families.

The question of the wolf as a predator has recently received much attention, and Murie has made an excellent study of this in Alaska, to which the reader is referred. Predator-prey relationship is a complex one. The predator may fluctuate greatly in numbers, irrespective of its prey. Normally the prey-species are adapted to withstand predation, and when the predator becomes too abundant and its prey scarce, the predator also sooner or later becomes scarce. Then the prey-species increase, perhaps until their food supply becomes depleted and a period of scarcity is indicated for them. Thus, there is no balance, but a huge pendulum swing.

Management is directed towards changing this swing to an artificial "Balance of Nature," and where there is much human hunting some control of wolf numbers may be necessary.

In the early 1930's Soper estimated the wolf population in Wood Buffalo Park at about 24 wolves to 200 square miles, or one wolf to about 8·3 square miles.

In Alberta wolf bounties were paid before 1931, and since 1936, the bounty varying from $2 to $10. The follow-

ing from provincial reports is the number of wolves on which bounties have been paid in certain years.

Year	No. of wolves
1936	187
1937	287
1938	361 (including 12 pups)
1939	729 (including 38 pups)
1940	633 (including 67 pups)
1942	773 (including 57 pups)
1943	528 (including 84 pups)
1944	695

That this apparently had no effect in controlling their numbers is shown by the increase in wolf pelts marketed during this period, as listed below.

The wolf is difficult to catch; it is a large, awkward animal to pelt on the trap-line; its capture demands much labour; the pelt is bulky to handle; and the price is relatively low. Hence, though common in the north it is not important as a fur animal.

The annual total values of the wolf taken from Alberta in the period 1919-20 to 1943-44 has varied between $700 and $39,606; the average value per pelt has varied annually from $4 (1934-35) to $25.20 (1936-37).

The Alberta wolf yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	136	1932-33	100
1920-21	371	1933-34	135
1921-22	...	1934-35	192
1922-23	2,129	1935-36	351
1923-24	184	1936-37	435
1924-25	283	1937-38	432
1925-26	157	1938-39	382
1926-27	115	1939-40	309
1927-28	190	1940-41	462
1928-29	186	1941-42	505
1929-30	165	1942-43	477
1930-31	205	1943-44	732
1931-32	130		

References

Criddle, 1925: Dominion of Canada, Dept. Agriculture, Bull. 13, N.S. (economic importance and control methods).

Murie, 1944: The Wolves of Mount McKinley (excellent life history and predation discussion).

Soper, 1942: Jour. Mammal., 23. pp. 131, 132 (Wood Buffalo Park; outside beds for young).
Young and Goldman, 1944: The Wolves of North America (general and taxonomic review).

FAMILY—FELIDAE. CATS AND THEIR RELATIVES

The cats are the most specialized of the carnivores in structure and habits. It is a widespread group, lacking only in Madagascar and the Australian area, and is especially rich in species in the tropics, where such representatives as the lion, tiger, panther, and jaguar occur.

Cats in general hunt singly, and by stealth. They are largely nocturnal, though also about by day, and many, with fully retractile claws, climb well. Many species have a distinctly patterned coat, and in some, as the cougar, where the adult lacks this, the young may differ from the adult and be patterned.

Three species of this family occur in Alberta. The young are born in a helpless condition, and are cared for in a nest by one or perhaps by both parents during infancy. Their food is largely fresh meat, which they catch themselves.

Two of our species, the bob cat and the cougar are American; one, the lynx, has a very close relative in the boreal part of the old world.

KEY TO ALBERTA SPECIES

(1) Tail more than half as long as body—cougar (*Felis concolor*)
(1a) Tail less than half as long as body 2
(2) Tail with tip black above and subterminal bars—bob cat (*Lynx rufus*)
(2a) Tail with tip black all around and no subterminal bars—lynx (*Lynx canadensis*)

Cougar. *Felis concolor* Kerr

(Also called Mountain Lion or Puma)

Diagnosis. Total length up to 112 inches (2.844 mm.) skull, greatest length 9½ inches, zygomatic breadth 6 $\frac{3}{11}$ inches. This, a male from Alberta, is the second largest trophy of this species listed in "North America Big Game" by Ely *et al.* in 1939. Weight up to about 200 pounds.

Colour, above tawny brown to grey, with black on the backs of the ears, on muzzle, and on tip of tail; eye stripe, legs, and underparts whitish.

The large size, tawny colour, and long tail are distinctive.

Geographical Variation With a range from northern British Columbia to Patagonia, the cougar exhibits variation that permits the recognition of nineteen subspecies according to a recent review; only one occurs in Alberta—*Felis concolor missoulensis* Goldman.

Distribution in Alberta. Fairly common in the Rocky Mountains of the west, perhaps rarely wandering eastward onto the plains.

Life History. One to 5 young born in the spring, after a gestation period of 90 to 92 days, in a rocky cavern or other shelter; food largely mammals, deer being an important item.

General. The cougar is one of the shyest and least often seen mammals of the forest.

Though rarely seen, it has a curiosity about humans that leads it to trail persons long distances, as hunters have found when they have recrossed their tracks and seen the cougar's tracks along with their own. Cougars have been accused of unprovoked attacks on humans, and there seem to be authentic cases of this, but they are extremely rare. The scream of the cougar, said to resemble the scream of a woman, is often spoken of but apparently rarely heard.

Figure 63. Cougar head.

This big cat originally spread as far east as Ontario. With a taste for livestock, especially foals, its presence

was incompatible with settlement and it had to disappear over much of its range. We are fortunate in having areas in the Rocky Mountains where these animals can continue to survive.

Bounties have been in effect in Alberta, and the following data give the number of cougars on which bounties have been paid in some years.

Year	No. of cougars	Bounties per animal
		$
1944	25	15
1943	41	15
1942	36	20
1940	57	20
1939	60	20
1938	39	20
1937	50	.....
1936	38	10

Lynx. *Lynx canadensis* Kerr

Diagnosis. Total length 872 mm. (34·2 in.); tail 93 mm. (3·6 in.); hind foot 222 mm. (8·7 in.) (an Alberta specimen, Preble); a short-tailed, long-legged cat with large feet, long ear tufts, and a pronounced ruff on sides of head and below chin; colour above generally a grey, grizzled blackish and buffy; below white, the underparts and flank and side of limbs obscurely marked with dusky; ear tufts black, tip of tail black all around; the ruff mixed with some black.

For comparison with bob cat *See* under that species.

Geographical Variation. With a wide range across the boreal part of North America (a closely allied species occurs in the northern forests of the Old World) it shows little variation, and the form that occurs in Canada is *Lynx canadensis canadensis* Kerr.

Distribution in Alberta. The coniferous forests of the north and the west.

Life History. Fluctuates greatly in numbers over about a 10-year cycle; 1 to 5 young born after a gestation period of probably about 63 days; food chiefly snowshoe rabbits.

General. The great coniferous forest is the home of the lynx. It is a shy, seldom seen animal, as are our other cats, and some trappers who have taken hundreds of them have never seen one outside of a trap or a snare. But this is in recent years. In times past when lynx were plentiful, and their main food supply, the snowshoe rabbit, failed, lynx in a starving condition roamed the forests more boldly.

The tremendous fluctuations of the lynx population numbers, following that of their chief food, the rabbit, has become a classical example of fluctuation, since the original researches of Seton and Hewitt These fluctuations follow about a 10-year cycle, from one year of peak numbers to the next. But the lynx has decreased greatly in recent years, and with each succeeding peak lower than the last, it seems that the lynx as an important fur bearer may become a thing of the past. Its long, fluffy fur makes its pelt one of the most valuable of the wild caught furs, but it has not been successfully raised in captivity.

Figure 64. Lynx.

The total annual value of the lynx taken from Alberta in the period 1919-20 to 1943-44 has varied between $23,878 and $141,320; the average value per pelt has varied annually from $15.74 (1931-32) to $49.09 (1943-44).

The Alberta lynx yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	1,045	1931-32	1,517
1921-22	....	1932-33	1,987
1920-21	2,027	1933-34[1]	2,112
1922-23	5,788	1934-35[1]	2,492
1923-24[1]	7,374	1935-36	2,300
1924-25	7,066	1936-37	1,560
1925-26	7,662	1937-38	822
1926-27	3,400	1938-39	734
1927-28	2,851	1939-40	1,028
1928-29	1,667	1940-41	760
1929-30	1,109	1941-42	772
1930-31	1,537	1942-43	1,271
		1943-44[1]	1,474

[1]The peak years 1923-24, 1933-34-35, and 1943-44 show the striking decline in peak years.

Reference

Elton and Nicholson, 1942: Jour. Animal Ecology, 11, pp. 215-243 (fluctuations).

Bob Cat. *Lynx rufus* Schreber

(Also called Wild Cat, Lynx Cat)

Diagnosis. Total length 40⅛ inches (1,001·9 mm.); tail 5⅞ in. (146 mm.); hind foot 6⅝ in. (165 mm.); skull, greatest length, 118·8 mm. (4·6 in.); zygomatic breadth 82·8 mm. (3·2 in.) (average measurement, Rollings, Minnesota). Weight, average 23 pounds (10-39¾ pounds) (Rollings). A short-tailed, rather long-legged cat with conspicuous ears, small eye tufts, and small ruff on chin; hind foot relatively small; colour above grizzled greyish or brownish, below white, with irregular conspicuous spottings on underparts and sides, and distinct black bar on inside of foreleg; ear tips black; black mixed in ruff; tail above like back, but with black tip and subterminal black bars; tail below, whitish to tip.

Though there are only two species of lynx or wildcats in western Canada, there are sometimes said to be three: the bob cat; the lynx cat; and the lynx. Rollings, who studied the question in Minnesota, writes that the bob cat is distinguished from the lynx by its hind foot being 7 inches or less (lynx over 9 inches); ear tufts rarely being

over 1 inch long (longer in lynx); by having black bar on inside of foreleg (absent in lynx); by having pelage short, buffy, and much spotted (long and almost solid grey in lynx); by the differences in tail coloration (*See* above); the bob cat is also smaller with less of a ruff on chin. There is much variation in colour and larger (and older?) individuals tend to be greyer and less spotted and are called lynx cats by trappers, who say it is a different species, and fur buyers sometimes quote a separate price for it.

Geographical Variation. With a widespread range in North America, up to southern Canada, there is considerable variation in colour and structure of this species, making a considerable number of subspecies recognizable, several of which at one time were considered species. Only one subspecies is recorded for Alberta.

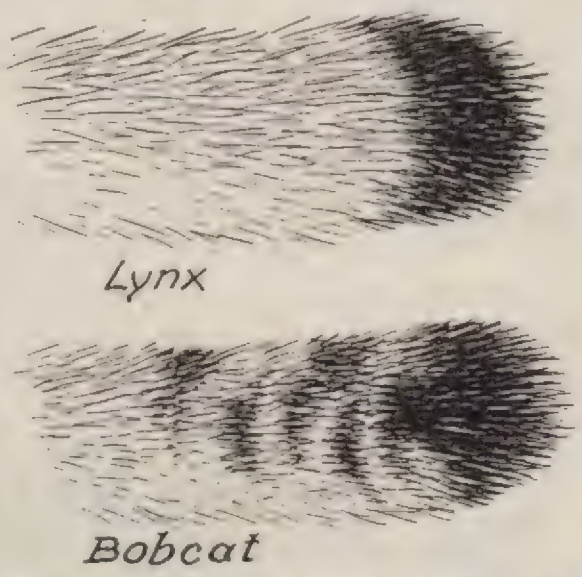

Figure 65. Tail of lynx (upper) and tail of bob cat, showing differences in markings.

Lynx rufus pallescens Merriam. Rare, occurs only in the extreme south.

Life History. Two to 4 young born in the spring after a gestation period of about probably 63 days (as in the European lynx), and cared for in a rocky cavern or other shelter; food, small mammals including rabbits, porcupine, mice, some birds, and occasionally deer.

General. The bob cat is a southern animal, preferring brushland and semi-wooded country rather than the heavy northern forests, where it is replaced by its northern relative the lynx.

The bob cat depends largely on its keen eyesight in securing food and wanders about or watches from some selected lookout until it sees its game. Then it stalks it expertly, until within range, and makes a sudden dash. If the capture is not made at once the chase is given up (Rollings).

The bob cat is so scarce in Alberta that the pelts listed for the period 1930-31 to 1941-42 total only 25, with six the highest number reported in any one year. The annual average value has varied from $1 to $4.

References

Dixon, 1925: Jour. Mammal., 6, pp. 34-46 (food).

Rollings, 1945: Jour. Wildlife Manag., 9, pp. 131-145 (winter habits and food in Minnesota).

Summer, 1931: California Fish and Game, 17, pp. 251-251 (habits and trapping methods).

ORDER—RODENTIA. RODENTS OR GNAWING MAMMALS

This does not include the rabbits and their relatives, which are here considered to belong to a different order, the Lagomorpha. The most obvious character separating the rabbits is that they have four upper incisors, a functionless pair just back of the two main ones, but there are other more important anatomical differences.

The rodents present a vast array of mammals. About 345 genera, containing 6,400 forms, are listed in a recent monograph prepared in the British Museum. This is probably more than a third of all existing mammals.

Their distribution is more widespread than that of any other group; they range into north polar regions, in Australia, and have spread into some of the islands of the Pacific.

In size many of them are small, but a weight of about 60 pounds is commonly attained by our beaver, and in South America are other rodents as large or larger, such as the Capybara that is said to be 4 to 5 feet long.

The variation in form and habits of the rodents is only exceeded by one other group of mammals, the marsupials. Some rodents are adapted for an arboreal life, like our squirrels, some even with a gliding membrane to aid in jumping from tree to tree as "flying squirrels". Other rodents are adapted for an aquatic existence, such as our muskrats and beaver, with very specialized habits; some

forms are as fossorial as moles, of which our pocket gophers are examples; though many forms run, scamper, or hop on the surface of the ground, some are adapted for leaping such as our kangaroo rat, and the jerboas of Africa. In furry covering one extreme is represented by the long stout quills of the Old World porcupines and the shorter more effective quills of the New World porcupines; and the other extreme by an African burrowing rodent, *Heterocephalus*, that has so few hairs on its skin that it appears naked.

In rodents the lips come together back of the incisors so that the animals can use them for gnawing without having unwanted material enter the mouth. Some forms have cheek pouches for carrying food. The food of this group is largely vegetable, but meat and insects are relished by many, and are probably important in the diet of some, such as our grasshopper mouse.

In Canada there are various adaptations for winter; some species such as some meadow voles and chipmunks, store food; some hibernate during the cold weather; some, like the banded lemmings, change their winter colour to white to match the snow. Some of our squirrels are diurnal, but many forms are nocturnal.

Rodents, besides supplying some valuable fur (beaver, muskrat, chinchilla), some human food (rabbits and marmots), and our domesticated guinea pigs (derived from the South American restless cavy), used as a pet and a laboratory animal, are extremely important as being the first stage in turning grass into flesh for use by many of the carnivorous animals. Indeed, much of the fur trade of Arctic Canada is based indirectly on lemmings and mice, and in years when the lemmings and mice are scarce, as happens regularly over a 4-year period, the staple fur, the arctic fox, also becomes scarce.

References

Ellerman, 1940: The Families and Genera of Living Rodents (a technical survey of the groups).

Elton, 1942: Voles, Mice and Lemmings (their fluctuations and its effect).

SYNOPSIS OF RODENT FAMILIES IN ALBERTA

(Based on species occurring in the province)

Family 1—Sciuridae (squirrels and their relatives). Size medium to small (length 200-800 mm.) (7·8-31·4 in.); body slender to stout; tail moderate, well haired, and in arboreal squirrels bushy and flattened; head rounded; no external cheek pouches; skull with post-orbital processes (lacking in other families) (p. 125).

Family 2—Geomyidae (pocket gophers). Size small (length 200-225 mm.) (7·8-8·8 in.); body stout; legs short; claws on fore paws elongated for digging; large, fur-lined cheek pouches opening outside the mouth (a character shared only with the Heteromyidae); tail scantily haired (p. 147).

Family 3—Heteromyidae (kangaroo rats and pocket mice). Size small (length 125-300 mm.) (4·9-11·8 in.); tail about as long as head and body; fore legs not stout and without elongated claws for digging; a pair of fur-lined cheek pouches opening outside of mouth (a character shared only with the preceding family) (p. 150).

Family 4—Castoridae (beaver). Size large (about 1 m. long) (39·3 in.); body robust; hind foot webbed; tail naked, scaly, and flattened (unique in the order) (p. 152).

Family 5—Cricetidae (mice and rats). Size mostly small (one, the muskrat, up to 530 mm. (20·8 in.) long); mouse- or rat-like in shape, without external cheek pouches; cheek teeth with crowns of re-entrant folds of enamel giving angular patterns, or tuberculate; the tubercules arranged in two longitudinal rows (p. 155).

Family 6—Muridae (Old World rats and mice). Size small (length up to 400 mm.) (15·7 in.); typical rat or mouse shape; cheek teeth with tubercules arranged in three longitudinal rows (p. 182).

Family 7—Zapodidae (jumping mice). Size small (length up to 250 mm.) (9·8 in.); shape mouse-like; fore legs short; hind legs very long; tail longer than head and body; upper incisors narrow and grooved in front (p. 185).

Family 8—Erethizontidae (American porcupines). Size large (for the order, length about 800 mm.) (31·4 in.); body stout; pelage of upper parts largely of spines (p. 189).

FAMILY—SCIURIDAE. SQUIRRELS AND THEIR ALLIES

In addition to what are usually thought of as "true squirrels", of which our red squirrel is an example, this family includes the marmots, chipmunks, ground squirrels (often called gophers in Alberta), prairie dogs, and flying squirrels.

This family has a widespread distribution, being absent only from Australia, Madagascar, and southern South America. It is a large group and the most brilliantly coloured species are found in the tropics.

In Alberta twelve species are found. They range in size from the tiny chipmunks to the hoary marmot that is over 2 feet long; many of them dig burrows around which their lives centre, and live in treeless country; some are arboreal forest animals; some hibernate; some store food; all but the flying squirrel are diurnal; their food is largely vegetable, but many relish animal food, such as insects, as well; the young are born in an undeveloped condition in a nest in some burrow or other hollow where they pass their infancy.

The word "gopher" as used in Alberta is usually applied to four of the species of ground squirrels. The word is too deeply rooted in the vernacular to change and must be accepted, but it must be kept in mind that even though ground squirrels have internal cheek pouches and are called gophers, they are not pocket gophers. Pocket gophers belong to another family, *Geomyidae*, of burrowing rodents that have external pouches opening on the cheeks and are fur lined.

Many of this family are of considerable importance to man; the red squirrel is a fur bearer of some importance; some of the ground squirrels are so abundant and so fond of grain that local control measures are necessary by agriculturists (though on open range they may be beneficial because of the insects they eat), and some of the ground squirrels are involved in the spread of disease such as bubonic plague and spotted fever, and perhaps others.

Figure 66. Alberta squirrels and relatives: *(a)* hoary marmot; *(b)* woodchuck; *(c)* Columbian ground squirrel; *(d)* red squirrel; *(e)* Franklin ground squirrel; *(f)* flying squirrel; *(g)* Richardson ground squirrel; *(h)* least chipmunk; *(i)* thirteen-lined ground squirrel; *(j)* mantled ground squirrel.

KEY TO ALBERTA SPECIES

(1) With gliding membrane—flying squirrel (*Glaucomys sabrinus*)
(1a) With no gliding membrane 2
(2) Conspicuous stripes on back 3
(2a) No stripes on back 4
(3) With five dark and four light stripes on dorsal surface—chipmunks (*Eutamias minimus, Eutamias amoenus, Eutamias ruficaudus*)
For a discussion of the differences separating these three very similar species *See* under *E. amoenus.*
(3a) With four dark and two whitish stripes on dorsal surface—mantled ground squirrel (*Citellus lateralis*)
(3b) With thirteen lines or rows of dots on upper parts—thirteen lined ground squirrel (*Citellus tridecemlineatus*)
(4) Size large (for the family), over 450 mm. (17·7 in.) 5
(4a) Size smaller, less than 400 mm. (15·7 in.) long 6
(5) General colour grey, white spot on top of nose—hoary marmot (*Marmota caligata*)
(5a) General colour brown, no white spot on top of nose—woodchuck (*Marmota monax*)
(6) Generally pale yellow-brown—Richardson ground squirrel (*Citellus richardsoni*)
(6a) Not so 7
(7) Nose and underparts reddish brown—Columbian ground squirrel (*Citellus columbianus*)
(7a) Not so 8
(8) Upper parts generally reddish brown—red squirrel (*Tamiasciurus hudsonicus*)
(8a) Head grizzled grey; back olive-brown—Franklin ground squirrel (*Citellus franklinii*)

Woodchuck. *Marmota monax* Linnaeus

(Also called Groundhog)

Diagnosis. Total length 482 mm. (18·9 in.); tail 117 mm. (4·6 in.); hind foot 70 mm. (2·7 in.) (Wood Buffalo Park specimen); body stout; legs short; claws stout, somewhat longer on fore paws than on hind paws; tail short, cylindrical, and somewhat bushy; fur rather long and coarse; colour, head blackish on top, grizzled whitish on sides; upperparts reddish brown, guard hairs with black subterminal section and whitish tips; top of tail like back; underparts and legs rich reddish brown, feet blackish. Melanistic examples are rare in our area.

The large size and stout body separate the woodchuck from all its relatives but the marmot, and the colour of the marmot, grizzled grey with a white patch on the nose, and still larger size, are sufficient to separate it from the woodchuck.

Geographical Variation. This species ranges from the eastern United States and Nova Scotia to Yukon, and a number of subspecies are recognized in Canada, of which the following one is represented in Alberta: *Marmota monax canadensis* Erxleben, to which the above diagnosis applies.

Distribution in Alberta. The northern part of the province, south at least to Entrance (Crowe), Red Deer River (Howell), and the vicinity of Islay and Edmonton.

Life History. Its life centres about its burrow, dug by itself; hibernates; about 4 to 9 young born in spring after a gestation period of about 30 days; food largely succulent vegetation, occasionally some bark of young trees.

General. Rocky, hilly country, sand ridges, and well-drained valleys are favourite woodchuck country in the north, though it is also found in timbered, alluvial flats (Soper). In settled country grassy fields and pastures are favoured.

With its burrows dug in the midst of its food supply the woodchuck's life is an easy one. It spends much of its time near the entrance of its burrow, sunning itself, or walking about with its lumbering gait, picking up bits of succulent vegetation. Alarmed it gallops clumsily back to its burrow, and if not too alarmed sits bolt upright to survey its surroundings and locate danger. Sometimes, in this pose, it is so upright that it seems to lean over backwards. In the autumn it becomes very fat, and although there is still plenty of food available, goes into its long winter sleep.

Groundhog day is February 2. Current belief has it that if on this day the groundhog sees its shadow, there will be 6 weeks more of winter; if it does not see its shadow, winter will be soon gone. It is obvious that this belief originated in a milder land. Seton says its origin is with

the negroes of eastern United States, but Bengtson indicates that it is imported from Europe where the same belief is held in regard to the Old World badger, another large burrowing animal.

References

Bengtson, 1945: Fauna, 7, pp. 114, 115 (superstition regarding weather forecasting).
Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 406 (occurrence, Entrance).
Hamilton, 1934: Ann. Carnegie Museum, 23, pp. 85-178 (habits, New York).
Howell, 1915: No. Amer. Fauna, No. 37 (habits and revision).
Seton, 1929: Lives of Game Animals (general).
Soper, 1942: Jour. Mammal., 23, p. 133 (habitat, Wood Buffalo Park).

Hoary Marmot. *Marmota caligata* Eschscholtz
(Also called Whistler)

Diagnosis. Males, total length 747 mm. (29·4 in.); tail 221 mm. (8·7 in.); hind foot 105·6 mm. (4·1 in.) (averages, Howell, for *M. c. oxytona*); body stout; legs short; claws stout, slightly longer on fore feet than on hind feet; tail short, cylindrical, and bushy; fur rather long and coarse; colour above, tip of nose black, a patch from back of nose to between eyes white; top of head black; back of neck and fore back whitish grizzled with blackish; hind back and tail similar, but tinged fulvus; sides of head grizzled white and blackish; underparts and legs grizzled greyish; feet black.

The large size, greyish coloration, and white spot on the nose are distinctive.

Geographical Variation. This western, mountain species, ranging from northern Alaska to Idaho, is divisible into about eight races, of which the following two are represented in Alberta:

(1) *Marmota caligata oxytona* Hollister. Represented in Alberta only in the Jasper area.

(2) *Marmota caligata nivaria* Howell. Similar in size and skull to *M. c. oxytona*, but very much whiter in coloration; ranges north to Banff (Crowe).

An additional form, *M. c. okanagana* (King), nearly as dark as *caligata* but with a broader skull, has been reported from Jasper and Banff, but a survey of the material in the National Museum does not support this.

Distribution in Alberta. The east slopes of the Rocky Mountains from the edge of the plains to above timberline.

Life History. Hibernates; about 5 young born in spring; food probably grass and herbs.

General. "The big hoary marmots are well named 'Whistler' by all mountain climbing people of the Canadian Rockies. Crossing an alpine flat, with its snow-banks, boulders, and quiet, one is often startled by a sharp, shrill whistle, which it is hard to believe does not signify nearness to a human being. A search of the surrounding flat reveals, however, only a fat, vigilant marmot, perched on a huge rock, and watching the intruder from a safe distance. The marmots are wary creatures, and at the first whistle of alarm all the animals inhabiting the flat seek a safe place near the burrow entrance, ready to retire at a flash". (Hollister).

Though usually wary animals of timberline and above, Mr. deVeber of Waterton Lakes found a group of them about the park headquarters cabin near Linnit Pond, and there they stayed about the buildings and came within a few feet of the personnel. At Banff they came down into rock slides by the golf course.

References

Anderson, 1934: Can. Field-Nat., 48, pp. 60-63 (distribution, with map).
Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 397 (taxonomic).
Hollister, 1912: Can. Alpine Jour., 4, pp. 28, 29.
Howell, 1915: No. Amer. Fauna, No. 37 (outline of habits, revision).

Mantled Ground Squirrel. *Citellus lateralis* Say

(Locally called Big Chipmunk)

Diagnosis. Total length 292·5 mm. (11·5 in.); tail 103·5 mm. (4·1 in.); hind foot 43·1 mm. (1·6 in.) (averages from Howell); front claws about twice as long as hind claws; colour, upper parts back to shoulder rich

bright reddish brown; rest of back and rump grizzled greyish brown; sides of back with a black longitudinal stripe, with a whitish yellow stripe below it, and a black one again below the whitish; underparts and sides up to the black stripe buffy except for throat and chin that are tinged reddish brown; hind feet buffy; fore feet tinged brownish; tail, above grizzled black, with a yellow fringe, below rich red-brown with a black submarginal band and a yellowish fringe.

The bright red-brown fore part of the body, and the one broad lateral whitish line bordered with a black line on each side, are distinctive. Chipmunks have an additional dorsal black stripe, are smaller, and have longer tails. In the hand the difference in claws is distinctive. The fore claws of the mantled ground squirrel are twice as long as those on the hind foot, whereas the fore and hind claws of the chipmunk are about equal in length.

Geographical Variation. This is a variable group of western ground squirrels that ranges from central British Columbia and Alberta south to Mexico, and is broken up into sixteen closely related subspecies and species (Howell) of which only one is represented in Alberta: *Citellus lateralis tescorum* Hollister, to which the above measurements and description apply.

Distribution in Alberta. The Rocky Mountains of the west.

Life History. More of a rock squirrel, less restricted to burrows than its relatives; hibernates; young 4 to 8 in number; food chiefly vegetable, including a wide variety of seeds and berries, mushrooms frequently eaten, as are various insects (Howell).

General. Sitting quietly on a rock slide above timberline in the morning sun this ground squirrel's reddish brown hood shines out as one of the most brilliant colours worn by any of our mammals.

"The mantled ground squirrels inhabit mountain slopes and foothills, living in the more open forested country among rocks and fallen timber. Their burrows are dug usually under rocks or stumps and the animals spend much time resting quietly on some rock or log in the sunshine.

They occasionally climb into bushes and trees to a height of 20 or 30 feet in search of food, but their ordinary habitat is on the ground" (Howell).

Of their economic importance Howell says that living in the mountains they rarely come into contact with civilization, but locally may do some damage to wheat, oats, or barley, and about camps they may make a nuisance of themselves by raiding food stores. They may also damage gardens locally.

Reference

Howell, 1938: No. Amer. Fauna, No. 56 (habits, revision, bibliography).

Columbian Ground Squirrel. *Citellus columbianus* Ord

(Also called Red or Mountain Gopher)

Diagnosis. Total length 358 mm. (13 in.); tail 92 mm. (3·6 in.); hind foot 47 mm. (1·8 in.) (Alberta specimen); ears small, tail short; front claws about twice as long as back claws. Colour, above, top of nose back to between eyes rather bright reddish brown; rest of upperparts greyish brown grizzled with black, giving a coarsely barred effect; somewhat greyer on thighs; legs and feet reddish brown, underparts somewhat paler reddish brown; tail, above grizzled brown and black with a submarginal band and a whitish fringe, below rather reddish brown with black submarginal band and white fringe.

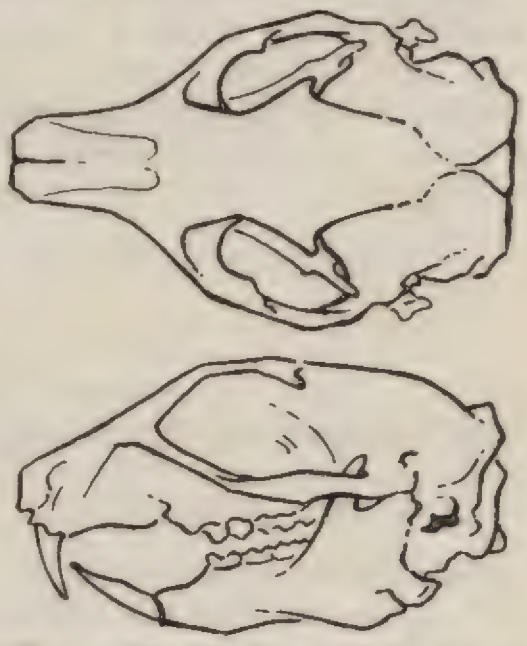

Figure 67. Skull of Columbian ground squirrel.

The bright reddish brown nose and face, and the reddish brown underparts are diagnostic.

Geographical Variation. Over its range from near Peace River south into Idaho and Oregon this species has

three recognizable subspecies. Alberta specimens are referable to: *Citellus columbianus columbianus* Ord.

Distribution in Alberta. The Rocky Mountains and their foothills of the west, into the edge of the plains in the southwest.

Life History. Digs burrows for shelter and sleeping; hibernates for 7 or 8 months (longer at high altitudes?); young, 2 to 5, rarely 7 (average 3·5); gestation period 24 days; food chiefly vegetable (grass, herbs, fruits, seeds) and some animal matter (insects and occasionally fish) (Howell).

General. The Columbian ground squirrel is a very common animal in the meadows above timberline, in the valleys where there is grassland throughout the mountain slopes, and in the south at least in the grassland on the edge of the plains.

When camped in summer in a grassy valley in the mountains, the whistled alarm notes of these ground squirrels are one of the commonest sounds. It should be a call of alarm, but one of them may be sitting bolt upright on the mound at the entrance to its burrow, chirping in time with its twitching tail, and a half score or more of its fellows may be feeding unconcernedly within a few yards, paying no attention to the calls. Sometimes they become a nuisance by entering tents and eating foodstuffs. Though in parts of their range to the south of us this species may be an agriculture pest, and Shaw has shown that in a season single animals kept in confinement under natural conditions destroyed on an average 50½ pounds of winter wheat (quoted by Howell), in Alberta their range for the most part does not include agricultural land. However, another aspect of its relationship to man is that in the United States it is involved in the spread of spotted fever and bubonic plague (Howell).

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, pp. 397, 398 (taxonomic).

Howell, 1938: No. Amer. Fauna, No. 56 (outline life histories, revision).

Shaw, 1918-1926: (sixteen important papers listed by Howell, p. 225)

Franklin Ground Squirrel. *Citellus franklinii* Sabine
(Also called Grey Gopher and Bush Gopher)

Diagnosis. Total length 385 mm. (15·1 in).; tail 130 mm. (5·1 in.); hind foot 54 mm. (2·1 in.) (Alberta specimen); claws on front feet about twice as long as those on hind feet; colour, top of head and neck black and grey grizzled, contrasting with rest of upperparts, which are rather rich olive-brown with rather conspicuous irregular barring; underparts and feet grey; tail, above grizzled grey and black, with a black submarginal band and a white fringe, below greyish white, with a partial submarginal black band.

The grey top of head contrasting with the olive-brown back, and the rather coarse barring is distinctive.

Geographical Variation. Though ranging from Illinois and western Ontario west to central Alberta, no significant variation occurs.

Distribution in Alberta. A restricted area in the parklands of central Alberta, west to Edmonton and north to Athabaska Landing.

Life History. Digs burrows, hibernates; young, 5 to 10 in number, born in burrow in spring; voice a musical whistle; food about two-thirds vegetable (includes clover, timothy, june grass, plantain, mustard, probably other wild plants, various crops, seeds, and berries); animal food includes insects, mice, young rabbits, and birds and their eggs (Howell).

General. The "grey gopher" seems to need shelter of some kind, tall grass or shrubbery. Apparently it is rare in Alberta east of Edmonton, for Soper saw only one in the Islay area. It disappeared into a poplar "bluff" and intensive hunting over many promising localities yielded not even a glimpse of another.

However, north of Edmonton, Preble found it very common, frequenting brushy tracts and the borders of cultivated fields, and doing considerable damage to the sprouting grain.

Howell says of their economic status that in localities where they are common they do considerable damage to

grain crops and invade gardens. They have been known to take small chickens and hens eggs (Howell).

References

Howell, 1938: No. Amer. Fauna, No. 56 (outline of habits, revision).
Preble, 1908: No. Amer. Fauna, No. 27 (occurrence north of Edmonton).
Soper, 1921: Can. Field-Nat., 35, pp. 106, 107.

Richardson Ground Squirrel. *Citellus richardsonii* Sabine
(Also called Flickertail, Yellow Gopher, Prairie Gopher)

Diagnosis. Total length 285·4 mm. (11·2 in.); tail 73·8 mm. (2·8 in.); hind foot 44·9 mm. (1·7 in.) (averages from Howell). Ears very small; tail short; claws on fore feet about twice as long as those on hind feet; colour, above generally pale greyish brown, lightly grizzled with blackish on back, with a slightly browner area on top of nose; underparts and feet chiefly whitish; tail, above mixed brown and blackish with an indistinct submarginal line of black. Some animals are much yellower than others.

The rather uniform pale colour of the upper parts of this species is distinctive.

Geographical Variation. This animal of the Canadian prairies and the western states to the south is divided into three subspecies (Howell) and is represented in Canada by a single subspecies: *Citellus richardsonii richardsonii* Sabine, to which the above diagnosis applies.

Distribution in Alberta. The plains and parklands of the south and central parts of the province north at least to Edmonton.

Life History. Makes dens into which it retires for shelter and sleep; hibernates; one litter a year of 6 to 11 young (average 7·5) born in the underground burrow after a gestation period of 28 to 32 days; voice a short, shrill whistle; food native grasses and flowering plants, seeds of various plants, and grain. Early in the season they cut off and eat the succulent stems of the grain, and when it is ripening they pull down the stalks and cut off the heads (Howell).

General. The plains country is the home of the flickertail, and it becomes extremely common. On the open prairie ridges between Medicine Hat and Brooks the mounds at the entrance of their burrows, and their connecting trails are so common that they form a conspicuous yellow pattern on the brown prairie.

The mound of earth is at the main entrance of the burrow. In sandy soil, continual passage of the animals may have worn the entrance large, up to 6 inches or more in diameter. But 10 to 20 feet away there may be other entrances, perhaps a group of six or eight of them, each just big enough for a squirrel, and without any mound of earth. These are probably later entrances dug up from the underground nest, and this would account for the lack of excavated earth about them.

Though so common locally, there are areas where one would expect these animals and there are none. Perhaps it is because they are colonial. But in a wide area between Manyberries and Wildhorse the local people say there used to be plenty of these animals about 8 years ago, and there are old burrows in evidence, but there are no flickertails there now. Rattlesnakes are common and it is held locally that their recent increase caused the disappearance of the ground squirrel in this area.

These ground squirrels are particular about just when they are abroad. They sleep all winter. Animals have been reported active in early April (Howell) and as late as early November (Soper). But also in the summer they seem to take a siesta period during the middle of bright days, and on rainy days they spend very little time out of their burrows.

Sometimes, when a traveller is camping on the plains, sitting quietly, one of these animals will come into camp even under a person's chair, with little or no alarm. At such times the gait is a walk; it seems as though the belly drags on the ground as the ground squirrel goes slowly about gathering prairie grass and stowing it in its cheek pouches, apparently to eat at leisure back in its burrow.

They get their name flickertail from their habit of rapidly twitching up their tail when excited, or alarmed, often accompanying this with a chirping or whistled call,

The gallop of the flickertail, as it heads back for its burrow, has a peculiarity. Every now and then the animal throws the fore parts of its body upwards; disturbing the rhythm of its gallop. It looks as though it were a mistaken effort to gain greater speed. It seems difficult to understand until you see the flickertail galloping through a patch of low dense grass. In places the grass seems too dense for the animal to force a way through, and then comes the little upward throw of the body, which lifts the shoulders above the level of the dense obstruction and allows it to scamper on.

The abundance of these animals and their fondness for grain makes it the most destructive of the ground squirrels. Local control is necessary by wheat growers. It is usually carried on by mixing a commercial "gopher" poison with oats or mixed grain and putting a spoonful down each burrow, where it is inaccessible to other animals.

This is one of the animals involved in the spread of bubonic plague and perhaps other diseases.

Reference

Howell, 1938: No. Amer. Fauna, No. 56 (outline of habits, revision, long bibliography).

Thirteen-lined Ground Squirrel. *Citellus tridecemlineatus* Mitchill

(Also called the Striped Gopher; Thirteen-Striped Spermophile)

Diagnois. Total length 244·2-284·9 mm. (9·5-11 in.); tail 80·7-104·7 mm. (3·1-4·1 in.); hind foot 33·9-39·8 mm. (1·2-1·5 in.); front claws about twice as long as hind claws. Colour above rather rich brownish black, with about thirteen longitudinal stripes and interrupted rows of dots running from shoulders to rump, below buffy; feet buffy; tail, above grizzled brown, with a submarginal band of black and a white edge, below red-brown toward base, paling terminally, with the black submarginal band and buffy fringe.

The pattern of the thirteen stripes is distinctive.

Geographical Variation. This species, with a range from Alberta to Ohio and south to Texas varies consider-

ably, and eight or more races are recognizable. The Alberta population are separable into two subspecies, a large, dark, northern form and a small, pale, southern form.

(1) *Citellus tridecemlineatus tridecemlineatus* Mitchill. Total length 284·9 mm.; tail 104·7 mm.; hind foot 39·8 mm. (averages from Howell); in the northern part of its Alberta range.

(2) *Citellus tridecemlineatus pallidus* Allen. Total length 244·2 mm.; tail 80·7 mm.; hind foot 32·9 mm. (averages from Howell); distinctly smaller and paler than the nominate race (Howell); extreme southern Alberta and southward (Anderson).

Distribution in Alberta. The southern and central parts of the province, north to Athabaska Landing and west to the edge of the mountains at Waterton Lakes.

Life History. Makes burrows; hibernates; young 5 to 13; gestation period 27 to 28 days; stores food; food a variety of small wild plants and seeds in addition to cultivated grains; are especially fond of grasshoppers and other insects (Howell and Wade).

Figure 68. Feet of thirteen-lined ground squirrel, showing long digging claws, especially on fore feet.

General. The "striped gopher" occurs in places along with the Richardson ground squirrel, but ranges farther north and seems to be much more localized. In places it seems to be more of a bushland animal. Preble writes that it was abundant along the road between Edmonton and Athabaska Landing, usually frequenting open uncultivated fields, but also seen running across the road in the poplar covered tracts. However, Rand found very few of these animals in extensive travel over the southern plains in 1945.

These ground squirrels destroy some grain, and garden produce, but against these destructive tendencies must be placed their fondness for grasshoppers, cutworms, webworms, and other injurious insects. Wherever the squirrels occur on extensive grasslands they are distinctly beneficial (Howell).

References

Howell, 1938: No. Amer. Fauna, No. 56 (habits, revision).

Preble, 1908: No. Amer. Fauna, No. 27.

Wade, 1927: Jour. Mammal., 8, pp. 269-276 (breeding habits).

Wade, 1930: Jour. Mammal., 11, pp. 160-188 (behaviour, hibernating).

[**Black-tailed Prairie Dog.** *Cynomys ludovicianus ludovicianus* Ord.

The black-tailed prairie dog has been found in Canada only in southwestern Saskatchewan, but it is possible that it may be found in Alberta. It is colonial in habit, and the groups of its burrows dug on the plains are called prairie dog towns, or dog towns. The prairie dog is a medium-sized rodent (total length 390 mm. (15·3 in.); tail 80 mm. (3·1 in.); hind foot 65 mm. (2·5 in.) with a stout body, very short ears, and short tail. The claws of both fore and hind feet are lengthened and adapted for digging; in colour it is rather uniform pale pinkish brown above, with a conspicuous black tip to the end of its tail. The underparts are yellowish white. For details of distribution *See* Soper, 1944, "Further Data on the Black-tailed Prairie Dog in Western Canada"; Jour. Mammal., 25, pp. 47-48.]

Least Chipmunk. *Eutamias minimus* Bachman

Diagnosis. Total length 197-217 mm. (7·7-8·5 in.); tail 88-101 mm. (3·4-3·9 in.); hind foot 31-33 mm. (1·2 in.); skull, greatest length 32-33, zygomatic breadth 18-19. Ears moderate, tail rather long and only slightly bushy; short, curved, climbing claws on all four feet; colour, top of head grizzled brown and grey; a blackish line through eye, a whitish line above and below eye, and then a dark line; back with five blackish longitudinal stripes separated by four greyish ones; shoulders and flanks more or less strongly washed with reddish brown; rump grizzled brown

and grey; underparts white; tail, above grizzled brown, black, and buffy, fringed with buffy, below buffy brown with a submarginal band of black.

This species is very similar to the two following species, which see for comparisons.

Geographical Variation. With a western distribution in the United States, and in Canada east to Ontario, the species has more than a dozen recognized subspecies, of which five are represented in Canada and the following two forms occur in Alberta:

(1) *Eutamias minimus borealis* Allen. Total length 217·4 mm.; tail 101·7; hind foot 31·3 mm.; skull, greatest length 33 mm., zygomatic breadth 18·3 (Howell); a rusty, red-brown form, occurring generally except in the extreme southwest.

(2) *Eutamias minimus oreocetes* Merriam. Total length 197·2 mm.; tail 88; hind foot 31·8; skull, greatest length 32·3 mm., zygomatic breadth 18·4 (Howell); a paler form with yellowish rather than rusty colour predominating, and with a shorter tail. Recorded from Waterton Park at higher altitudes and Mount Forget-me-not.

Distribution in Alberta. General in the north; local in the south where brushlands occur on the plains; occurs at lower altitudes in the Jasper Park area and at high altitudes in Waterton. The distribution and ecological relationships of the chipmunks of the Rockies would repay study.

Life History. Digs and utilizes burrows; stores food; becomes inactive and probably hibernates in winter; young 4 to 6 in number; food largely vegetable, seeds and fruits (Howell); many insects eaten in the early autumn (Aldous).

General. These little chipmunks, of the brushland and open forests and forest edges, are among the most attractive of our mammals. Though usually terrestrial they sometimes climb. Sometimes tracing what seems to be the low, short call of a bird repeated many times, one may find it given by one of these chipmunks, perched on a low

branch. When the animals are at rest the long tail is often switched from side to side, but when running it is elevated at a sharp angle.

They commonly climb into berry bushes for the berries, and seem to do this for the seed in them, cutting open the berries, stuffing the seeds into their cheek pouches, and dropping the pulp.

They are usually shy and ready to dash away to shelter at any approach. Above timberline they go scampering away far ahead over the slopes. However, they become very tame about camps and settlements where they are fed.

References

Aldous, 1941: Jour. Mammal., 22, pp. 18-24 (food habits).
Howell, 1929: No. Amer. Fauna, No. 52 (revision).

Allen Chipmunk. *Eutamias amoenus* Allen

Diagnosis (of Alberta forms). Total length 217-222 mm. (8·5-8·7 in.); tail 96-102 mm. (3·7-4 in.); hind foot 33-34 mm. (1·2 in.); skull, greatest length 33-34, zygomatic breadth 19; shape and colour very like that of the little chipmunk, *E. minimus*. Colour, top of head grizzled brown and grey, a blackish line through eye, a whitish line above and below eye, then a dark line; back with five longitudinal blackish stripes separated by four whitish stripes; shoulders and flanks washed with rusty red; rump grizzled greyish brown; underparts of body whitish (*ludibundus*) or buffy (*luteiventris*); tail, above black and clay coloured, below clay coloured with a submarginal black fringe.

Compared with the little chipmunk, to which it is similar, the buffy belly of the southern form *luteiventris* is distinctive. The northern form *ludibundus* has white underparts and compares with the little chipmunk *E. minimus borealis* as follows: "Total length about the same but tail averaging slightly shorter and hind foot considerably larger; skull slightly larger and relatively broader across zygoma, the rostrum longer and narrower; sides of body, hind feet, and under surface of tail darker; light dorsal stripes clearer white (less mixed with cinnamon); rump and thighs more greyish (less ochraceous)" (Howell).

The next species, *E. ruficaudus*, the rufous-tailed chipmunk, is a larger, more richly coloured, white-bellied animal.

Geographical Variation. This is a species of the western United States and Canada, in which about ten races are recognized, of which two occur in Alberta as follows:

(1) *Eutamias amoenus luteiventris* Allen. Total length 221·5 mm.; tail 101·8; hind foot 33·2; skull, greatest length 34·2; zygomatic breadth 19 (averages from Howell). This form has a buff-coloured belly; recorded from Banff to Waterton.

(2) *Eutamias amoenus ludibundus* Hollister. Total length 217 mm.; tail 96·4; hind foot 33·5; skull, greatest length 33·8; zygomatic breadth 19 (averages, Howell); similar in colour to *luteiventris* but head and rump slightly more greyish (less ochraceous); underparts mainly white (rather than buff) and tail averaging darker tawny beneath (Howell); in the Jasper area in the mountains.

Life History. Presumably like that of the little chipmunk, *E. minimus;* makes burrows; stores food; becomes inactive or hibernates; 4 to 6 young born; food chiefly seeds and fruits.

General. Where horses have been fed and oats spilled these chipmunks gather to profit by the waste. They stuff their cheek pouches full of the grain, then carry it to their underground caches to store it for future use.

Burned over areas, with a criss-crossing of fallen dead timber forming a network of highways for these animals seems to be a favourite habitat. Here, too, berry bushes and grass grow to yield their seeds, and scattered rocks and hollow logs provide refuges.

Though similar in habits and appearance to the little chipmunk, there are striking peculiarities about the ranges of the two species in the Jasper and Waterton Lakes area; in the Jasper area the little chipmunk lives in the lowlands, being replaced in the mountains by the Allen chipmunk that is most common at lower altitudes, but occurs to timberline (Hollister); in the Waterton Lakes area conditions are reversed—the little chipmunk is a timberline species and the Allen chipmunk occurs below it, at lower

altitudes; about Banff both species occur together at altitudes of 6,500 to 7,000 feet, but the present species is common lower.

References

Hollister, 1912: Can. Alpine Jour., 4, special number, pp. 30, 31 (distribution, habits).
Howell, 1929: No. Amer. Fauna, No. 52 (revision).

Rufous-tailed Chipmunk. *Eutamias ruficaudus* Howell

Diagnosis. Total length 231·2 mm. (9 in.); tail 106·2 mm. (4·1 in.); hind foot 35 mm. (1·3 in.) (averages, Howell). Colour, top of head brown, grizzled with grey, a dark line through eye, and a light, then a dark line both above and below; five blackish, longitudinal stripes separated by four whitish stripes on back; shoulders rather bright rufous; sides greyish heavily washed with rufous; rump dark brown and grey, grizzled; under side of body white; tail, above mixed black and tawny with a tawny fringe, below rufous with submarginal black band.

Distinguished from the other chipmunks by its larger size, and more rufous shoulders and tail (often evident in life), and its larger skull with more slender rostrum.

Geographical Variation. A species of the mountains of the northwestern United States, and western Canada, two subspecies have been recognized of which one is represented in Alberta, and to which the above diagnosis applies: *Eutamias ruficaudus ruficaudus* Howell.

Distribution in Alberta. The eastern slopes of the Rocky Mountains; common at moderate elevations in the Waterton area.

Life History. Probably like that of the two preceding species; digs burrows; hibernates; 4 to 6 young; food seeds and fruits.

General. When the morning sun comes peering into the clearings on the heavily forested mountain slopes, these chipmunks come out onto logs or fallen tree tops to enjoy the sun's warmth. They have a scolding note, like that of their near relatives, sometimes running so closely together that the result is almost a trill.

A group of species such as the three chipmunks, the little, Allen, and rufous-tailed, is always intriguing to a naturalist. They look so much alike that for many years experts did not have their names straightened out. They are difficult to tell apart in the field, yet presumably they recognize each other unerringly. That their habitat requirements are different is indicated by their distribution on the mountain slopes above Waterton Lakes, where Allen chipmunks live commonly at low altitudes; rufous-tailed at intermediate altitudes; and the little chipmunk scampers about over the talus at timberline. Some day an energetic student will make a comparative study of these animals that will add to our knowledge of how species came into existence.

References

Anderson and Rand, 1943: Can. Field-Nat., 57, p. 135 (distribution).

Howell, 1929: No. Amer. Fauna, No. 52 (revision).

Red Squirrel. *Tamiasciurus hudsonicus* Erxleben

Diagnosis. Total length 321·7-331·8 mm. (12·6-13 in.); tail 127·3-137·8 mm. (5-5·3 in.); hind foot 43·3-50·5 mm. (1·6-1·9 in.); a bushy tailed tree squirrel with short curved claws for climbing; colour above reddish brown, tail the same with a submarginal band of black; underparts white in summer with a black line along flanks at the edge of the red-brown; brighter coloured in winter, with longer fur on the ears, and lacking the black line on the flanks.

Geographical Variation. The red squirrel has a continent wide distribution in the coniferous forests, and is broken up into a number of subspecies of which three have representatives in Alberta, as follows:

(1) *Tamiasciurus hudsonicus preblei* Howell. Total length 331·8 mm.; tail 137·8; hind foot 50·5 (averages, Howell); a bright-coloured form; the northern part of the province.

(2) *Tamiasciurus hudsonicus columbiensis* Howell. Total length 321·7 mm.; tail 127·3; hind foot 43·3 (averages, Howell); like the above, but tail averages shorter,

upperparts in winter darker, more olivaceous, and less suffused with buff; feet tawny rather than grey; tail darker, with darker edgings; skull averages smaller; the Rocky Mountains from Banff northward.

(3) *Tamiasciurus hudsonicus richardsoni* Bachman. Total length 322 mm.; tail 120; hind foot 49 (Waterton Lake specimen); a much darker form; in the extreme southwest, intergrading with *columbiensis* over a wide area (Crowe).

Distribution in Alberta. The coniferous forests of the north, and of the mountains in the west.

Life History. Arboreal and terrestrial; does not hibernate, but becomes inactive for days at a time in bad weather; sleeps in burrows and in stick nests in trees; young usually about 6, born in the spring after a gestation period of about 6 weeks (Hatt); seeds of conifers are an important food, but eats many other seeds, buds, mushrooms, berries, and sometimes takes nesting birds and insects; in winter comes to meat bait readily.

Figure 69. Feet of red squirrel, showing short, curved, climbing claws.

General. The red squirrel is the favourite of the forest to many people. It is the mammal most likely to be seen in the seeming endless stretches of conifers. When the squirrel learns of the presence of an intruder, he probably does not freeze to escape observation, or flee to remove himself from danger but approaches to investigate, and usually it seems that he is not pleased with what he finds, if one can judge by the vehement chattering and scolding he indulges in as he dances about on a low branch, or hangs head downward from some tree trunk. But he is never still for long. His amazing energy is well illustrated

by the following note from a mountain climber: "Approaching timberline . . . I had just climbed a steep slope, slippery from pine needles, perhaps 300 feet high, and thrown myself down to rest under the shade of one of the few scattered pines to regain my breath. Looking down I saw a squirrel come bounding up the steep slope I'd just toiled up. Without a pause he surmounted the slope, then ran to the top of a pine tree, decided it was the wrong one, ran down again and up the next one to sit on a topmost branch and give his cheery trill while I wondered whence came all his energy and wind."

In the early days of the fur trade red squirrels were considered worthless, but in recent years they have assumed an important place in the fur trade.

The annual total value of the squirrel taken from Alberta in the period 1930-31 to 1943-44 has varied between $22,143 and $1,589,738; the average value per pelt has varied annually from 7 cents (1932-33) to 60 cents (1943-44).

The Alberta squirrel yield is as follows:

Year	No. of pelts	Year	No. of pelts
1930-31	247,991	1937-38	1,024,856
1931-32	288,494	1938-39	1,709,152
1932-33	316,333	1939-40	3,026,091
1933-34	1,366,326	1940-41	1,534,804
1934-35	1,179,165	1941-42	4,967,933
1935-36	473,898	1942-43	1,165,367
1936-37	1,309,239	1943-44	689,039

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 400 (taxonomic).
Hatt, 1929: New York State College Forestry, Syracuse, Roosevelt Wildlife Annals, Bull., vol. 2, No. 1 (life history and habits).

Flying Squirrel. *Glaucomys sabrinus* Shaw

Diagnosis. Total length 315-322 mm. (12·4-12·6 in.); tail 140-149 mm. (5·5-5·8 in.); hind foot 39·5-41·7 mm. (1·5-1·6 in.). Gliding membranes extend from wrist to ankle; tail wide and very flat; eyes large; fur long, fine, and soft; colour, above greyish or cinnamon brown, with slaty colour of under fur showing through when fur is disarranged, below whitish tinged yellowish or cinnamon.

The flat wide tail and the gliding membranes set this off from any other of our mammals.

Geographical Variation. This species with a transcontinental range in the coniferous forests is divisible into a number of races, of which the following three are represented in Alberta:

(1) *Glaucomys sabrinus sabrinus* Shaw. Total length 315 mm.; tail 140; hind foot 40 (Howell); northern and central Alberta, east of the mountains.

(2) *Glaucomys sabrinus alpinus* Richardson. Total length 322 mm.; tail 149; hind 41·7 (averages, Howell); like *sabrinus*, but upperparts much greyer (less vinaceous); tail darker; and skull larger with broader brain case (Howell); the northern part of the Rocky Mountains of the west, south at least to the Jasper area.

(3) *Glaucomys sabrinus bangsi* Rhoads. Total length 315 mm.; tail 142; hind foot 39·5 (averages, Howell); similar in size and colour to *sabrinus*, but upperparts averaging more drab (less vinaceous or ochraceous) and underparts more clouded with pinkish cinnamon (never yellowish white as in *sabrinus*); feet greyer; differs from *alpinus* in upperparts being decidedly more vinaceous; tail paler and much less clouded with fuscus (Howell); the southern part of the Rocky Mountains of the west.

Distribution in Alberta. The coniferous forests of the northern and central parts of the province, and the mountains of the west.

Life History. Nocturnal, largely arboreal; active throughout year; sleeps in hollow tree or stick nests (built by themselves?); young, 3 to 6 in number; gestation period probably about a month; store some food; food largely seeds, with a pronounced fondness for meat; some insects eaten (Howell).

General. The flying squirrel differs from all our other squirrels in being abroad only by night. It is the most arboreal of our squirrels, and its gliding membranes allow it to make sailing jumps as long as 50 yards. The squirrel leaps from high up on one tree, swoops down, and sharply

upwards at the end of the glide to light on the trunk of another tree. It is able to guide its course in the air and to turn to the left or the right.

The men who trap for fur are the persons who know how common the flying squirrels are. Their appetite leads them into meat-baited marten and weasel traps, and the trapper resents their presence for to him they are worthless.

Even where common, they are seldom seen by a person in the forest; perhaps one will come gliding down to land with a thump on the tent; or one may be heard running about over a cabin roof; or the blow of an axe on a dead stick may cause a flying squirrel, sleeping in an old woodpecker's hole, to poke its head out. But much watchfulness in a favoured place is necessary to see these little animals gliding from tree to tree in the dim light of the forest at night.

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, pp. 400, 401 (distribution, taxonomy).

Howell, 1918: No. Amer. Fauna, No 44 (outline of habits, revision, bibliography).

FAMILY—GEOMYIDAE. POCKET GOPHERS

This group of rodents is found only in north and central America. All of the many species are burrowing animals, spending much of their time underground, and all are similar in appearance and rather small in size.

Their food is largely roots and tubers, but succulent vegetation is also eaten. The large, hair-lined cheek pouches that open outside the mouth are used for transporting food; the young are born in an undeveloped condition.

The pocket gophers carry the earth from their underground tunnels to the surface and leave it in mounds, afterwards completely blocking the entrance to the tunnel. These mounds, or gopher hills, are frequently called "mole hills" in Alberta, and attributed to moles, though no moles occur in Alberta (as discussed earlier, page 123). Thus, we get a confusion of the names of two subterranean, little known mammals, and one common, conspicuous one. Ground

squirrels are generally called gophers; and pocket gophers' burrowings (the animals are apparently seldom seen) are attributed to moles.

Pocket gophers are of economic importance locally because they feed on such root crops as potatoes, damage some field crops by eating the roots, and damage irrigation projects with their burrows.

Only one species occurs in Alberta.

Pocket Gopher. *Thomomys talpoides* Richardson

Diagnosis. Total length 199-214 mm. (7·7-8·2 in.); tail 47-60 mm. (1·8-2·3 in.); hind foot 26·5-29 mm. (1-1·1 in.); skull basal length 34·5, zygomatic breadth 23; a stout-bodied, short-legged animal with small eyes and ears; very sparsely haired tail, greatly elongated claws on fore feet; fur-lined cheek pouches opening outside of mouth; colour above greyish brown, nose greyish, ear patch blackish; underparts buffy to white; tail whitish; winter pelage greyer.

Geographical Variation. Many subspecies of this western North American species are known, of which three occur in Alberta:

(1) *Thomomys talpoides talpoides* Richardson. Total length 214 mm.; tail 60; hind foot 28 (large male, Bailey); in central Alberta.

(2) *Thomomys talpoides andersoni* Goldman. Total length 199 mm.; tail 54; hind foot 29; similar to *T. t. talpoides* in size, but paler above and below (Goldman); occurs in southern Alberta.

(3) *Thomomys talpoides loringi* Bailey. Total length 199 mm.; tail 47; hind foot 26·5 (Bailey); smaller and more pale than *talpoides;* smaller and more reddish than *andersoni;* form not well known; apparently occurs south and west of Edmonton.

Distribution in Alberta. Locally common in central and southern Alberta, west to the mountains in the south.

Life History. Subterranean in habits; active throughout the year; probably about 6 young born in an unde-

veloped state underground; food roots, gathered through burrowing, and green vegetation gathered at the surface; some food stored (Bailey).

General. Even where pocket gophers are common they are seldom seen, and the knowledge of their presence is usually known from the mounds of earth thrown out from their burrows. This earth is pushed out ahead of the animal, and the entrance is then plugged firmly with earth until it is usually difficult to find the entrance to the burrow. The large cheek pouches are not used for carrying dirt, but for carrying food. When filled the apparent size of the head is more than doubled.

Figure 70. Pocket gopher; note the long fore claws; the study on the left shows the external cheek pouches distended.

Gophers run backward through their burrows, with ease, and the stubby tail probably serves as a tactile organ, as a substitute for eyes, in this backward progress in the darkness of the burrows.

Most of the gopher's life is spent underground, going from place to place along the burrows, or making new burrows. The texture of the soil has an important bearing on the distribution of pocket gophers, and in Alberta they are local in distribution.

Bailey has pointed out that in some areas pocket gophers are next in importance to ground squirrels in causing damage to the agriculturists. Pocket gophers eat tubers, and all kinds of garden vegetables; most field crops are eagerly eaten, either above or below the surface; they destroy many hay crops, and leave mounds of dirt that dull or break the knives of mowing machines; and burrow

through the banks of irrigation ditches. However, in Alberta their distribution makes these damages very local problems.

Reference

Bailey, 1915: No. Amer. Fauna, No. 39 (summary of habits, revision).

FAMILY—HETEROMYIDAE. POCKET MICE AND KANGAROO RATS

This is an exclusively American family, largely restricted to western North America. The name pocket mouse refers to the fur-lined cheek pouches that have their openings outside the mouth, a character common to the family and shared with the pocket gophers. Some of this family are mouse-like in shape and have a scampering gait; others have greatly elongated hind legs and a hopping gait that have given them the name of kangaroo rats.

Figure 71. Head of Kangaroo rat, from skin, showing openings of cheek pouches.

Correlated with living in a dry habitat some species at least have become practically independent of water for drinking, and Howell and Gersh report that several species of kangaroo rats have been kept in good condition, without water, on a diet of rolled oats, for several months, a diet that would not enable white rats to survive a week. However, Bailey writes that under desert conditions they obtain water from succulent vegetation, and in captivity learn to drink water.

One species of kangaroo rat is recorded from Alberta, and one pocket mouse may be expected.

[Pocket Mouse. *Perognathus fasciatus fasciatus* Wied

Total length 129 mm. (5 in.); tail 56 mm. (2·2 in.); hind foot 17 mm. (Criddle); a small, slender mouse with conspicuous fur-lined cheek pouches opening outside the mouth; colour above olive-grey, underparts white bordered

with buffy; recorded in Manitoba and ? in Saskatchewan, and is to be expected in southern Alberta. Bailey (1926, No. Amer. Fauna, No. 49, p. 119) writing of North Dakota says they are small, inconspicuous, mainly nocturnal animals of the open prairie, where they live in tiny burrows in the barest situations or on the short grass plains, for unlike most mice they avoid the cover of vegetation. Criddle writing of Manitoba says they prefer sandy soil and the entrances of their burrows are usually hidden in a clump of weeds (1915, Ottawa Nat., 28, pp. 130-134).]

Kangaroo Rat. *Dipodomys ordii* Woodhouse

Diagnosis. Total length 266-282 mm. (10·4-11 in.); tail 143-157 mm. (5·6-6·1 in.); hind foot 43, 44 mm. (1·6 in.) (Hoffmeister for *D. c. terrosus*); hind legs much longer than fore legs, tail long, tufted; fur-lined cheek pouches opening outside the mouth; colour above dark buff or tawny; white mark above eye, by ear, and along each hip; underparts white; tail dusky above and below, white on sides.

The shape and colour pattern are distinctive.

Geographical Variation. Many subspecies of this western United States species are recognized, and specimens from Alberta have been referred to: *Dipodomys ordii terrosus* Hoffmeister.

Distribution in Alberta. Apparently a straggler into the southwest.

Life History. Hibernates (?); nocturnal; makes burrows; young 3 to 4 in number; food chiefly seeds of grass, grain, and herbs (Bailey).

General. Many authors have pointed out that these beautiful, attractive, gentle animals are not rats nor mice, but have as their closest living relatives the burrowing pocket gophers, and are more closely related to squirrels than to rats.

Kangaroo rats are animals of open country where they make an elaborate system of burrows from which they wander widely in search of their food. As one would

expect from their form, they travel by hopping on their hind legs, but it comes as a surprise to find that they also climb into tall weeds and shrubs (Bailey).

Reference

Bailey, 1936: No. Amer. Fauna, No. 55 (habits).

FAMILY—CASTORIDAE. BEAVERS.

This family contains only two very similar species, one in Europe and Asia and one in North America. They are very large rodents, being surpassed in size only by the Capybara of South America.

Beaver are modified in structure for an aquatic existence, with a tail form that is unique among the rodents, but the American species is even more specialized in habits. Its cutting of trees, and building of dams and lodges, has given rise to a vast amount of folk-lore, recorded in the earlier literature. Its valuable pelt was one of the important inducements to early exploration and travel in Canada, and the beaver has a place on the Canadian coat of arms. The young are born in an undeveloped condition in a lodge or in a burrow. One species occurs in North America.

Beaver. *Castor canadensis* Kuhl

Diagnosis. Total length 900-1,088 mm. (35·4-42·8 in.); tail 270-407 mm. (10·6-15·9 in.); hind foot 170-177 mm. (6·6-7 in.); tail large, flat, paddle-like, and scaly; a cleft claw on second toe of the hind foot; colour, brown above, paler brown below.

Geographical Variation. The beaver is widespread across Canada, with variation permitting a number of races to be recognized, of which the following two occur in Alberta:

(1) *Castor canadensis canadensis* Kuhl. Total length 1,088 mm. (43 in); tail 407 mm. (16 in.); hind foot 177 mm. (7 in.) (Seton); skull, basal length 118·8, zygomatic breadth 94 (Benson, averages); northern, central, and western Alberta.

(2) *Castor canadensis missouriensis* Bailey. Total length 900 mm.; tail 270; hind foot 170; skull, basal length 110, zygomatic breadth 87 (Bailey, type); slightly smaller than *canadensis* and much paler and duller brown; skull more triangular in outline, not so massive and heavy (Bailey); southern Alberta.

Distribution in Alberta. Widespread on streams.

Life History. Largely nocturnal, also abroad by day; aquatic; builds dams and houses; 1 to 9 (usually 4 or 5) young born after a gestation period of 94 to 128 days; food, bark of trees, aspens and willows being favourites, and succulent vegetation; stores food for winter.

Figure 72. Beaver.

General. A typical beaver family consists of a pair of adults, the yearlings, and the kits. When the young are entering their third spring, and are nearly 24 months old, they set out for themselves.

Their family home is the lodge; a dam is built to regulate the water supply, making sure the lodge entrance is covered and that there is enough water so that it will

not freeze to the bottom in winter. Trees are felled and a supply of branches cut and laid down under water. When winter comes and the ice is thick the beavers are safe from the natural enemies that can never dig down through the frozen roof of their lodge, and when hungry they have simply to swim to their food pile and bring a piece into their lodge to eat at their leisure.

Where beaver are protected they have become very tame, and it is possible to watch them feeding and swimming about within a few yards.

The beaver was the chief staple of the fur trade in the early days, but beaver are so easily trapped that their continued existence as commercial fur bearers was threatened. This being realized, measures involving closed seasons and areas, and trap lines have been put into effect, and beaver have been transplanted to areas from which they were extirpated. Under intelligent management they will always yield a rich harvest.

But beavers are not always an unmixed blessing. Their dams sometimes flood roads and interfere with culverts and bridges. On the plains of the south where trees are few and jealously guarded, beaver cause extreme annoyance by their cuttings, as in Milk River town where there used to be a grove of poplars until the beaver cut them.

The total annual value of the beaver taken from Alberta in the period 1919-20 to 1941-42 has varied between $2,642 and $374,940; the average annual value per pelt has varied from $6.24 (1933-34) to $25 (1926-29).

The Alberta beaver yield is as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	5,685	1930-31	206
1920-21	11,195	1931-32	4,647
1921-22	....	1932-33	9,279
1922-23	2,903	1933-34	4,401
1923-24	20,057	1934-35	1,996
1924-25	18,747	1935-36	416
1925-26	15,089	1936-37	3,897
1926-27	9,153	1937-38	6,006
1927-28	736	1938-39	6,365
1928-29	845	1939-40	6,996
1929-30	233	1940-41	7,782
		1941-42	3,438

References

Bailey, 1922: U.S. Dept. Agric., Bull. 1078, 31 pp. (habits, control, farming).

Barbeau, 1941: Beaver, Outfit 272, pp. 14-18 (in Canadian Art).

MacFarlane, 1905: Proc. U.S. Nat. Mus., 28, pp. 742-748. (beaver trade and its history in the northwest).

Soper, 1937: Jour. Mammal., 18, pp. 1-13 (in Wood Buffalo Park).

Warren, 1927: Amer. Soc. Mammal., Monog. 2 (general, habits).

FAMILY—CRICETIDAE

This is a very large assemblage of small rodents that as a group are well represented in the New World, and in

Figure 73. (*a*) White-footed mouse, one of the Cricetinae; (*b*) Meadow mouse, one of the Microtinae.

the northern part of the Old World, with some members in Africa.

Miller recognizes two subfamilies in the New World.

Figure 74. Some Alberta mice: *(a)* bog lemming; *(b)* meadow mouse; *(c)* grey Phenacomys vole; *(d)* Mackenzie Phenacomys vole; *(e)* jumping mouse; *(f)* red-backed vole; *(g)* chestnut-cheeked vole; *(h)* long-tailed vole; *(i)* upland vole; *(j)* white-footed mouse; *(k)* brown lemming; *(l)* kangaroo rat; *(m)* grasshopper mouse; *(n)* pallid vole; *(o)* Richardson vole.

DIAGNOSTIC EXTERNAL FEATURES OF THE TWO SUBFAMILIES

(Based on Alberta species)

Subfamily 1—Cricetinae. Ears and eyes large and conspicuous (p. 156).

Subfamily 2—Microtinae. Ears and eyes small and inconspicuous (p. 163).

Subfamily 1—Cricetinae. Cricetine Rodents

This group has a distribution from the Arctic to Patagonia in the New World, and the greater part of the Palæarctic region in the Old World, with members in South Africa and Madagascar (Ellerman). In Alberta four species occur.

The Alberta forms are typical rat and mouse in shape and appearance. The young are born in an undeveloped state, blind, naked, and helpless, in some nest. The food of the adults varies with the species; of two, seeds are important; of one, herbaceous vegetation bulks large; and of the other, animal matter, chiefly insects, seems to be most important. Some store food. One species is extremely adaptable in habitat requirements whereas others are selective. They are mostly terrestrial, but some climb well; all are active throughout the year.

The mice of this group in Alberta mostly come into contact with man when they enter wilderness dwellings, where they cause local damage and loss. Their insect eating tendencies are probably important in keeping down noxious insects affecting forests and grazing. The common species, as a food for some fur bearers, are probably extremely important.

KEY TO ALBERTA SPECIES OF CRICETINE RODENTS

(1) Total length over 300 mm. (11·8 in.), tail bushy—bushy-tailed wood rat (*Neotoma cinerea*)

(1a) Total length less than 200 mm. (7·8 in.), tail not bushy 2

(2) Tail about twice the length of hind foot—grasshopper mouse (*Onychomys leucogaster*)

(2a) Tail about three times the length of hind foot—white-footed and deer mice (*Perobyscus mamiculatus, Peromyscus leucopus*)

(For discussion of differences between these last two species *See* page 160).

Grasshopper Mouse. *Onychomys leucogaster* Wied

Diagnosis. Total length 141 mm. (5·5 in.); tail 37 mm. (1·4 in.); hind foot 21 (Saskatchewan female); tail short, thick at the base, and tapering; colour, above grizzled grey, below white.

The short, thick, tapering tail is the best external character for separating it from the white-footed mouse, which it most resembles.

Geographical Variation. The grasshopper mice, a western group, extend into Canada only in the southern edge of the prairies. More than twenty forms in two species are recognized, of which only one occurs in Alberta, as follows: *Onychomys leucogaster missouriensis* Audubon and Bachman.

Distribution in Alberta. The south part of the province (Calgary and Medicine Hat, Hollister).

Life History. Probably active throughout the year; largely terrestrial (? does not burrow); two litters a year; 1 to 6 young in a litter, born in spring and summer after a gestation period of 33 to 39 days (Svihla); young weaned at 19 to 24 days; food, as determined by laboratory examination of stomachs, eight-ninths animal matter (food in which grasshoppers, crickets, caterpillars, and moths bulk large) (also eats other mice); about one-ninth was vegetable food, composed mostly of seeds of grasses and cultivated grains (Sperry); in captivity store food (sunflower seeds) (Bailey).

General. These are prairie animals found scattered over the open country in bare and exposed situations as well as where there is cover of weeds and scattered shrubbery. They seem to wander widely, and rarely is there any trail, burrow, or sign found that can unmistakably be assigned to them.

Much of our knowledge of them comes from studies of captive animals, and though they are unknown to local residents of their range, the grasshopper mice have a number of extremely interesting and unusual habits.

Many rodents relish insects and flesh, but the grasshopper mouse depends to a large extent on such food, and even attacks and kills other mice for food. Its name comes

from its fondness for grasshoppers. It is said to take the place of the short-tailed shrews and moles as insect eaters in the central part of the continent where the latter are absent.

Not only does the grasshopper mouse have a squeak or bark, but it also has a long, fine, shrill whistle, insect-like in fineness and quality, that Bailey heard about his camps on the plains and likens to the wolf howl in miniature.

In captivity, it has been observed to take tobacco from a cigar butt, chew it briefly, and then parting its fur apply the tobacco to its skin, as though for an insecticide.

References

Bailey, 1926: No. Amer. Fauna, No. 49 (habits).
Bailey and Sperry, 1929: U.S. Dept. Agric., Tech. Bull. No. 145 (habits and food).
Hollister, 1914: U.S. Nat. Mus., Proc. 47, pp. 427-489 (revision).
Svihla, 1936: Jour. Mammal., 17, pp. 172, 173 (breeding).
Walker, 1940: Jour. Mammal., 21, p. 221 (using tobacco on skin).

Deer Mouse. *Peromyscus maniculatus* Wagner

(Also called Wood Mouse, White-footed Mouse)

Diagnosis. Total length 158-160 mm. (6·1-6·2 in.); tail 63-71 mm. (2·4-2·7 in.); hind foot about 20; adult, colour above, pale ochraceous buffy to greyish cinnamon or drab; below white; tail sharply bicoloured, blackish above, white below; a white spot at base of ear often present; worn pelage browner; juvenile pelage grey.

Closely resembling the next species, the white-footed mouse, which *See* for comparisons.

Geographical Variation. This is one of the most widespread and variable species of mammal in North America, ranging from the Atlantic to the Pacific coast, and from Central America to tree line in the north. In Alberta are two rather distinct subspecies as well as wide areas from which specimens show intergradation.

(1) *Peromyscus maniculatus borealis* Mearns. Total length 160 mm.; tail 71; hind foot 20 (averages, topotypes, Osgood); colour, above greyish cinnamon to drab or hair

brown, much like the adolescent pelages of related forms; white hairs in basal ear tuft usually well developed; underparts creamy white; tail deep dusky, almost black, above, white below (Osgood). The northern part of the province.

(2) *Peromyscus maniculatus osgoodi* Mearns. Total length 158·5 mm.; tail 63·7; hind foot 20·1 (averages, Montana, Osgood); like *borealis* but colour decidedly paler, more buffy ochraceous; size slightly smaller; tail averaging shorter (Osgood). The plains of the southern part of the province.

The animals from the east slopes of the Rocky Mountains are a variable, confusing group that show a mixture of characters of the surrounding races; *borealis* from the northeast; *osgoodi* from the southeast; and *alpinus* to the west (Crowe). Crowe writes that *artemisiae*-like specimens in this area are the result of the intergradation set forth above.

Life History. Active throughout the year; terrestrial and somewhat arboreal; nocturnal; about 5 young born after a gestation period of 22 to 35 days (Svihla), in some sheltered nest; food chiefly seeds, some insects are eaten.

General. This is one of the most adaptable animals in Alberta, along with the coyote and the wolf. It is found in the northern forests; in the sage bush flats of the southern plains, where it sometimes seems to be the only small mammal; and at timberline in the mountains. There are at times, perhaps, more of these mice in Alberta than of any other species of mammal. Soper estimated that there might be 46,000 animals to the square mile in Wood Buffalo Park. But with this species, as with so many of our mammals, the populations have their ups and downs; sometimes they are scarce; sometimes common.

The big ears, big eyes, graceful shape, and beautiful colour make the deer mouse one of our most attractive mammals. Though nocturnal they are fortunately not shy, and sitting at the door of a tent at dusk, there is always a good chance to see these mice come foraging about one's feet, looking for bits of food that have been dropped, or for the crumbs that may have been spread for them.

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, pp. 401, 402 (taxonomic).
Osgood, 1909: No. Amer. Fauna, No. 28 (revision).
Soper, 1942: Jour. Mammal., 23, pp. 135, 136 (Wood Buffalo Park).
Svihla, 1932: Univ. Mich. Mus. Zool., Misc. Pub. No. 24 (life history study).

White-footed Mouse. *Peromyscus leucopus* Rafinesque

Diagnosis. Total length 168 mm. (6·5 in.); tail 69 mm. (2·7 in.) hind foot 22 (averages, Montana, Osgood); colour above ochraceous buff, very lightly mixed with dusky; middle of back somewhat darker than sides but not sharply constrasting; head and face nearly like sides; underparts creamy white (Osgood).

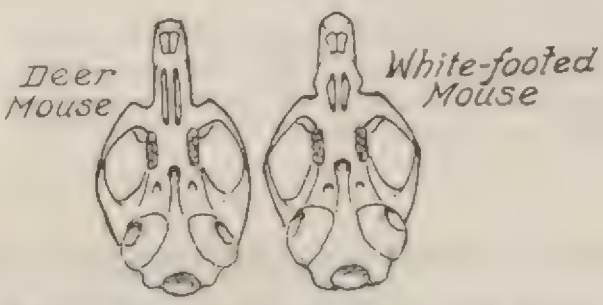

Figure 75. Skull of white-footed mouse and deer mouse (left).

This species is easily confused with *Peromyscus maniculatus osgoodi*, the deer mouse, that lives in the same area. In colour they are very similar, but *P. m. osgoodi* is specifically distinct and is to be distinguished by its smaller size, shorter tail, and in most cases by the presence of definite white spots in front of the ears; the tail is also more hairy and sharply bicoloured. In skull characters *osgoodi* has a narrower brain case, smaller audital bullae, longer more parallel-sided palatine slits, and smaller molar teeth (Osgood).

Geographical Variation. This is a more southern species that intrudes into southern Canada, with only one subspecies in Alberta: *Peromyscus leucopus aridulus* Osgood, to which the above diagnosis applies.

Distribution in Alberta. The southern part of the province.

Life History. Active throughout the year; nocturnal; terrestrial, but climbs well; 1 to 6 young (average about 5) born after a gestation period of 22 to 27 days (Svihla) in some sheltered nest; food chiefly seeds; some insects eaten.

General. Osgood writes that though the white-footed mouse lives in arid country, it appears that it lives chiefly in the relatively humid parts; that is, along watercourses and in the slightly wooded places. The more open and arid part of the region is inhabited by the deer mouse (*P. m. osgoodi*). Soper found it comparatively rare on our western prairies, as thousands of trap nights produced only a few examples. On the basis of collected specimens he secured one of this species to twelve deer mice.

References

Hamilton, 1941: Jour. Mammal., 22, pp. 250-263 (food).
Osgood, 1909: No. Amer. Fauna, No. 28 (revision).
Soper, 1946: Manuscript (survey of prairie mammals).
Svihla, 1932: Univ. of Mich., Mus. Zool., Misc. Pub. No. 24 (life history).

Bushy-tailed Wood Rat. *Neotoma cinerea* Ord
(Also called Pack Rat)

Diagnosis. Size, total length 382-387 mm. (15-15·2 in.); tail 162-167 mm. (6·2-6·5 in.); hind foot 43-44 mm. (1·6 in.); a large rat-like animal, with a bushy, somewhat flattened tail, big eyes and ears, and very conspicuous "whiskers"; colour, above greyish buff to ochraceous buff, the back mixed with darker hairs; below white; tail above brownish grey, below white; young much greyer above.

Geographical Variation. This is a western species with two slightly differentiated subspecies in Alberta.

(1) *Neotoma cinerea cinerea* Ord. Total length 387 mm.; tail 162; hind foot 43 (averages, Montana specimens, Goldman); in the extreme south and southwest.

(2) *Neotoma cinerea drummondii* Richardson. Total length 382 mm.; tail 167; hind foot 44 (averages, Jasper House, Goldman); similar to *N. c. cinerea* but fur longer, tail more bushy on distal two-thirds; dark colour of forelegs ending in a sharp line near wrist, in strong contrast

with pure white of feet; skull averages slightly larger, dentition slightly heavier (Goldman). Occurs in the Rocky Mountains south to Banff.

Distribution in Alberta. The mountains of the west and the Milk River country.

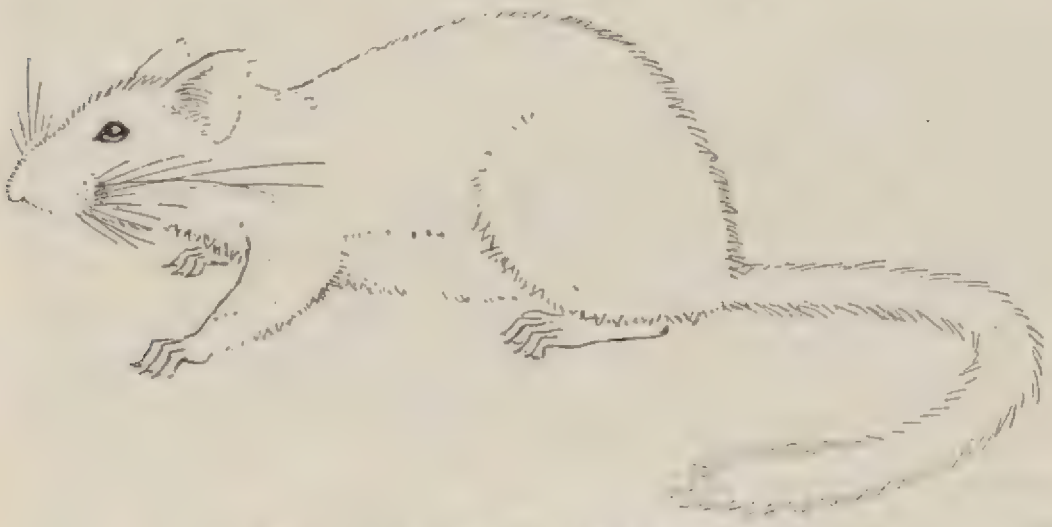

Figure 76. Bushy-tailed wood rat.

Life History. Active throughout the year; largely nocturnal; terrestrial and good climbers; make large stick nests in rock crevices and buildings; one litter of 2 (sometimes 3 or 4) young a year (Bailey) born after a gestation period of probably about 30 to 33 days (as in related forms); food chiefly green vegetation and some seeds; store dry herbaceous plants as food.

General. The wood rat seems to need the shelter of rocks or of buildings in which to live in Alberta. Though largely nocturnal, it is sometimes abroad during the daylight hours; when watching a rock slide for pikas one may see a wood rat dashing across the rocks with a mouthful of green stuffs for its food cache.

Hollister writes, "Mountain-rats take readily to buildings, and their nocturnal activity has made them famous among mountain-people. The stories of their freakish antics, as told around the evening camp-fire by guides, prospectors, and packers, rival the most exciting bear stories in interest. One packer told of his return to his shack to find his bunk filled with potatoes and dried fruit,

and another of the strange disappearance of large quantities of provisions, which were later found in some ridiculous place, where the pack rats had stored them.

"The nests of this mountain form are usually placed on rocky hillsides, under large boulders. A mass of sticks, bones, and available miscellaneous articles is piled about the nest proper. The nest sites are always ill-smelling places, and the animals when killed give off a strong characteristic odour which persists for years in the stuffed skins. In the museum if the door of a case containing bushy-tailed wood rats is left open, the fact is at once apparent to any one in the room who happens to be familiar with the species."

Though wood rats are said to make interesting pets, and their presence adds interest to our mountain wilderness, their usurping of cabins and cottages left vacant brings them into disrepute. Having gained entry into such a building their excrement, voided everywhere, may leave such a disgusting and nauseating odour that the place becomes uninhabitable.

References

Bailey, 1936: No. Amer. Fauna, No. 55 (habits in Oregon).
Goldman, 1910: No. Amer. Fauna, No. 31 (revision).
Hollister, 1912: Can. Alpine Journal; special number, pp. 18, 19 (in Jasper area).

Subfamily ?—Microtinae, Microtine Rodents; Voles and Lemmings

The distribution of the microtine rodents is in the northern parts of both the Old and the New World. They form a dominant group, and the number of species and of individuals is very large.

In Alberta eleven species occur. They are small to medium-sized rodents (the largest is the muskrat) with mouse-like shape, but with heavy body, short legs, small ears and eyes, and, often, short tails (though the tail may be long as in the muskrat). The young are born in an undeveloped condition, blind, naked, and helpless, in a nest in some sheltered place or in a burrow. The habitat requirements of the Alberta species are varied; one is

aquatic; the others are terrestrial; most of them make burrows and runways; many are grassland animals but some favour arid treeless country, and some forested areas. Their food is predominantly herbaceous vegetation, and some species store food. All are active throughout the year.

In cultivated areas some species of these voles may cause damage by eating green stuff. In irrigation sections the muskrats' burrows damage canals and earthen dams. These damages are usually local. On the credit side, from our point of view, is the fact that these mice are very important, being among the agents in the first stage in the process of turning grass into flesh. These rodents are also important as food for some of our important fur bearers, such as weasels, martens, and foxes. One of these voles, the muskrat, is an important fur bearer itself.

Many of these small rodents fluctuate greatly in numbers; in some years they may be common, other years scarce, and in some areas at least in Canada the scarcity of microtines seems to cause a scarcity of certain furs.

KEY TO ALBERTA MICROTINE RODENTS

(Voles and their relatives)

(1) Size large, total length over 400 mm. (15·7 in.); tail as long as head and body, and compressed laterally—muskrat (*Ondatra (zibethica)*

(1a) Smaller, total length less than 300 mm. (11·8 in.) tail shorter than head and body, and round 2

(2) Colour reddish brown or chestnut 3

(2a) Colour blackish or greyish brown 4

(3) Thumb nail strap-shaped; tail about equals hind foot—brown lemming (*Lemmus trimucronatus*)

(3a) Thumb with claw, tail about twice hind foot—red-backed mouse (*Clethrionomys gapperi*)

(4) Tail little, if any, longer than hind foot..... 5

(4a) Tail distinctly longer than hind foot 6

(5) Colour light buffy grey—pallid vole (*Lemmiscus curtatus*)

(5a) Colour dark grizzled brown—northern bog lemming (*Synaptomys borealis*)

(6) A distinct chestnut-coloured patch on side of nose—chestnut-cheeked vole (*Microtus xanthognathus*)

(6a) No such patch 7

(7) Total length over 200 mm. (7·8 in.)—Richardson vole (*Microtus richardsoni*)

(7a) Total length less than 200 mm. (7·8 in.) 8

(8) Tail about three times length of hind foot—long-tailed meadow vole (*Microtus longicaudus*)

(8a) Tail about twice length of hind foot 9

(9) Colour grizzled black and grey, lacking distinct brownish tones—upland vole (*Pedomys minor*)

(9a) Colour grizzled brownish 10

(10) Lower molars with re-entrant angles of about equal depth on inside and outside of teeth (Figure 77)—short-tailed meadow mouse (*Microtus pennsylvanicus*)

(10a) Lower molars with re-entrant angles, very much deeper on inside than on outside of teeth (Figure 77)—Phenacomys vole (*Phenacomys intermedius*)

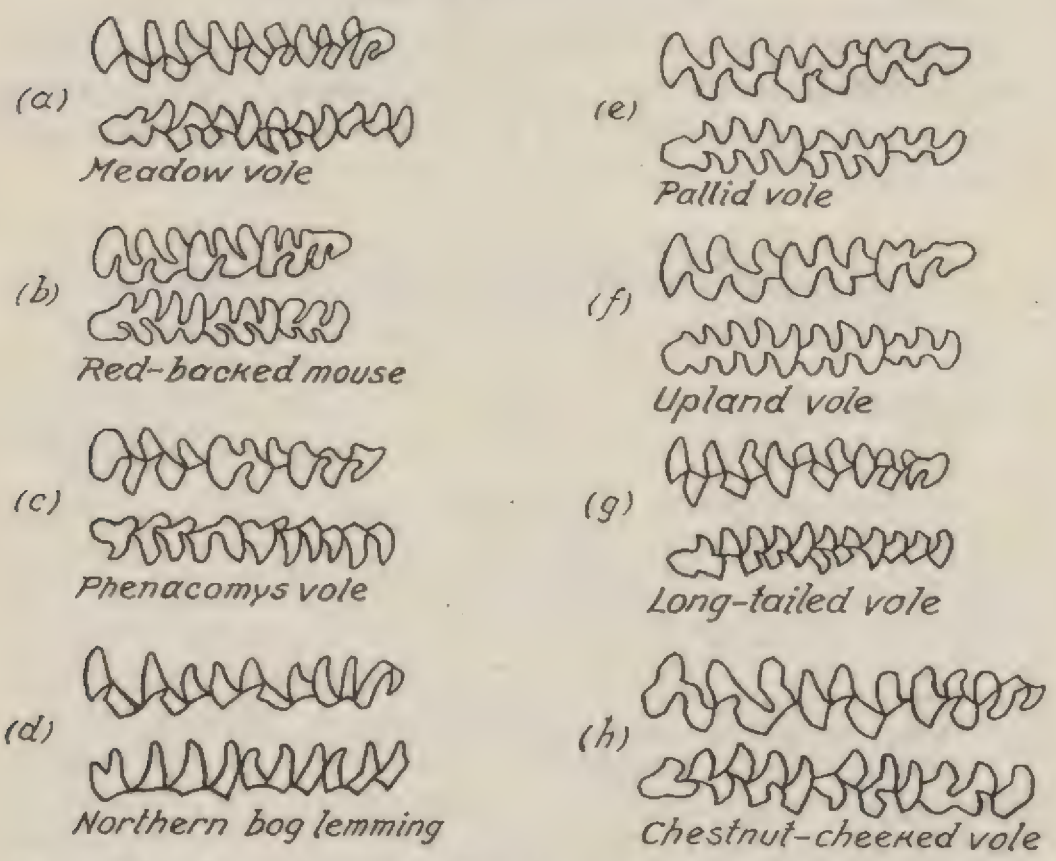

Figure 77. Enamel pattern of molars of: (*a*) meadow vole; (*b*) red-backed mouse; (*c*) Phenacomys vole; (*d*) Northern bog lemming; (*e*) pallid vole; (*f*) upland vole; (*g*) long-tailed vole; (*h*) chestnut-cheeked vole.

Northern Bog Lemming. *Synaptomys borealis* Richardson

Diagnosis. Total length 129-131 mm. (5-5·1 in.); tail 25-26; hind foot 18; colour, above grizzled brown to grey; below slaty; in old males white hairs on flank glands conspicuous; teeth with diagnostic molar pattern (*See* Figure 77), with lower molar pattern composed entirely of transverse wedge-shaped loops, with deep re-entrant angles on the inner side of the teeth and hardly a trace of external re-entrant angles; the upper incisors are grooved (Figure 78).

Figure 78. Grooved upper incisors of bog lemming.

The general vole-like appearance and colour, the short tail (less than twice the length of the hind foot), in old males the white flank spots, and the tooth characters are diagnostic.

Geographical Variation. This is a northern, North American species, with a dark brownish race in northern Alberta, and a duller, greyer race in the mountains of the southwest, as follows:

(1) *Synaptomys borealis borealis* Richardson. Total length 129 mm.; tail 26; hind foot 18 (Howell, averages for Northwest Territories specimens). Colour above very rich and dark, plentifully mixed with black-tipped hairs; richness of colour most pronounced on rump (Howell); occurs in northern Alberta, south to Edmonton.

(2) *Synaptomys borealis chapmani* Allen. Total length 131 mm.; tail 25; hind foot 18 (Howell, averages for specimens from west of Henry House); a dark but dull-coloured race with only a slight tinge of chestnut (Howell); southwestern Alberta.

Distribution in Alberta. Northern and central Alberta, and the mountains of the west.

Life History. Active throughout the year; makes runways in grass and moss of bogs and forests; young 2 to 7 in a litter (judging from embryos in Alberta specimens), born at various times in spring and summer in Alberta; food apparently herbaceous vegetation.

General. Rarity is the thought that usually comes to mind in connection with these little animals. Soper writes

that in Wood Buffalo Park in 75,000 trap nights he collected only five specimens. However, locally on the east slopes of the Rockies they may be quite common. Such a place was found in 1945. It was in the little sphagnum-shrubby glades in the spruce forest along a tributary of Bow River. Here, lengths of grass cut up by voles, runways and burrows of voles were everywhere. Some of these signs were probably made by meadow voles (Microtus) and some probably by this species, as five bog lemmings, four adults and one young, were taken one night, as well as a number of meadow voles.

It is a seeming paradox that most of our life history studies of small mammals are based on dead animals. But such is the case, and it is collectors' notes on the labels of specimens as to where specimens were taken, the food that was in their mouths and stomachs, whether or not females were gravid, and if so the number of embryos, on which our knowledge of such forms as this is built.

Reference

Howell, 1927: No. Amer. Fauna, No. 50 (revision).

Brown Lemming. *Lemmus trimucronatus* Richardson

Diagnosis. Total length 159 mm. (6·2 in.); tail 23; hind foot 21 (Davis, averages); colour above tawny to chestnut, grizzled with black, brighter on the rump; nail on thumb flat and strap-shaped.

The bright, red-brown colour, the short tail about the length of the hind foot, and the strap-shaped thumb nail are distinctive external characters.

Figure 79. Left front foot of brown lemming, showing strap-shaped thumb nail.

Geographical Variation. This is a northern species of the tundra, extending southward in the mountains as far as western Alberta where the bright colour form occurs, to which the above diagnosis applies, and which is called:

(1) *Lemmus trimucronatus helvolus* Richardson.

Distribution in Alberta. The northern part of the mountains in the west.

Life History. Active throughout the year; does not turn white in winter; in the north, 3 to 9 young, born at any time of year in a nest of grass; food probably chiefly grasses, sedges, and herbs.

General. The brown lemming is closely related to the Norwegian lemming, which is so well known from its habit of increasing greatly in number in certain years and then making mass migrations. When these migrating hordes reach the sea they are said to swim straight out and all perish.

The Stanwell-Fletcher's, writing of north-central British Columbia, indicate that in the mountains the brown lemming also fluctuates greatly in numbers, reaching plague proportions in some years. When plentiful they were found in many and varied types of habitat, not only above timberline in alpine meadows but in rock slides, sphagnum bogs, in valley bottoms, in forests, and an unusual habitat record is included, "four were found in the stomachs of Dolly Varden Char." Their runways connect and wind in every direction for considerable distances. Green cuttings of grass cover the floor of the deeper recesses of the burrows, which are also of considerable length; one of the burrows measures a little over 11 feet in length.

References

Davis, 1944: Murrelet, 25, pp. 19-25 (revision).
Stanwell-Fletcher, 1943: Occ. Papers B.C. Prov. Mus., No. 4, pp. 89, 90.

Phenacomys Vole. *Phenacomys intermedius* Merriam

Diagnosis. Total length 135-138 mm. (5·3-5·4 in.); tail 32-34; hind foot 17 mm.; colour, above grizzled brown; with or without yellow on sides of nose (varying with the subspecies); below grey; feet pale to white; tail dark above, pale below; the diagnostic features lie in the skull, most obvious in the enamel pattern of the molars (*See* Figure 77) in which the transverse loops of the lower molars have the re-entrant angles on the inner (tongue) side much deeper than the outer re-entrant angles.

For positive specific identification recourse to the tooth pattern is necessary. That of the lower molars sets this species off sharply from all other Alberta microtines.

The molar pattern of these species is most closely approached by *Synaptomys*, and the differences are apparent in the figures. In addition, *Synaptomys* has grooved upper incisors in contrast with the non-grooved incisors of *Phenacomys*.

Geographical Variation. Howell in his revision had three species, *P. intermedius*, *P. Mackenzii*, and *P. ungava*, that replaced each other in a northern, continent-spanning succession. Anderson considers *mackenzii* and *ungava* to be conspecific, and Crowe has shown that *intermedius* and *mackenzii* intergrade. It seems advisable to recognize one, polytypic species for the forms formerly grouped under these three species names and with this concept we have in Alberta two well-marked races.

(1) *Phenacomys intermedius levis* Howell. Total length 135 mm.; tail 34; hind foot 17 (Montana averages, Howell); without yellowish on sides of nose; the slopes of the Rocky Mountains.

(2) *Phenacomys intermedius mackenzii* Preble. Total length 138 mm.; tail 32; hind foot 17 (Fort Smith averages, Howell); face yellowish (also good skull differences, such as the strongly depressed rostrum, etc.); the northern and central part of the province, integrading with *P. i. levis* in the northern foothills of the Rocky Mountains.

Distribution in Alberta. The northern and central part of the province, and the Rocky Mountains of the west.

Life History. Active throughout the year; 4 to 6 young in a litter, probably more than one litter a year (Alberta data); food apparently green vegetation.

General. Like the bog lemmings, this is usually considered one of the rarities in the catch of the small mammal collector. Soper, in his intensive work in Wood Buffalo Park, did not find this species, though Preble had taken it there earlier. But again like the bog lemmings it is not uncommon, at times at least, on the east slopes of the Rocky Mountains where series have been taken in open,

grassy pine forests, in mossy pine forests, in spruce forests, and at timberline. Sometimes it is taken where there are no evident signs of runways; sometimes where there are runways through the grass and burrows in the moss that might have been made by it or one of the three or four other microtine species that occur there.

References

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 403 (shows *P. intermedius* intergrades with *mackenzii*).

Howell, 1926: No. Amer. Fauna, No. 48 (revision).

Red-backed Mouse. *Clethrionomys gapperi* Vigors

Diagnosis. Total length 123-146 mm. (4·8-5·7 in.); tail 31-41; hind foot 17-19; back brownish red; sides yellowish brown; underparts whitish; a brown-backed colour phase occurs occasionally that must be identified by its skull; the skull is smoother and weaker than in most other of our microtines, and the enamel pattern of the molars is characterized by the rounded, rather than angular loops (*See* Figure 77).

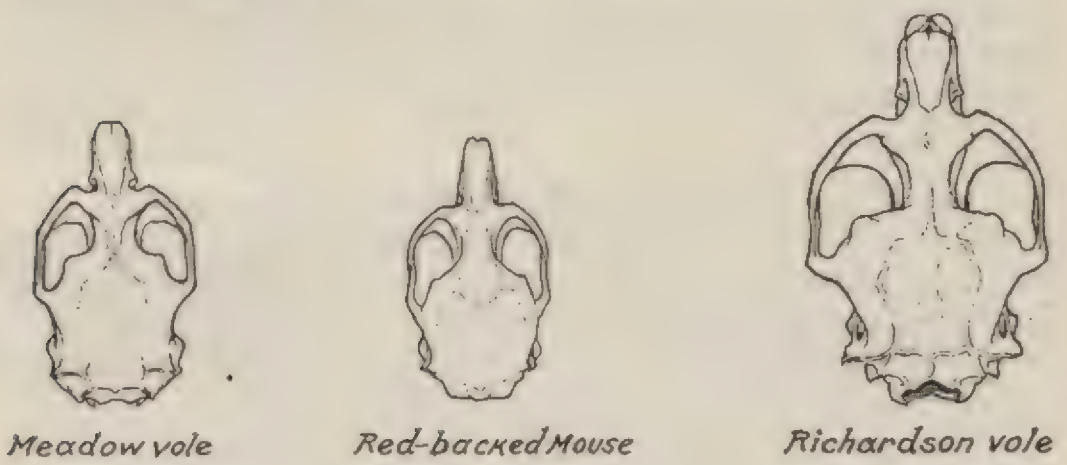

Figure 80. Dorsal view of skulls of: left, meadow vole; middle, red-backed mouse; right, Richardson vole.

Geographical Variation. This is a wide ranging, northern forest species, that is represented by three subspecies in Alberta, with intergradation with a fourth in the western mountains.

(1) *Clethrionomys gapperi athabascae* Preble. Total length 145·6 mm.; tail 40·6; hind foot 18 (averages, Fort Chipewyan specimens, Preble). The northern part of the area.

(2) *Clethrionomys gapperi galei* Merriam. Total length 145 mm.; tail 43·6; hind foot 18·2 (Colorado averages, Bailey); colour slightly paler; in the southern part of the Rocky Mountains in Canada.

(3) *Clethrionomys gapperi loringi* Bailey. Total length 123 mm.; tail 31·5; hind foot 17·9 (averages, North Dakota, Bailey); a small, brightly coloured form; central Alberta eastward.

(4) *Clethrionomys gapperi saturatus* Rhoads. Total length 149 mm.; tail 45; hind foot 18·2 (averages, Bailey); a large, long-tailed form with larger ears and stouter hind feet; occurs in British Columbia, intergrading with Alberta forms on the east slope of the Rocky Mountains.

Distribution in Alberta. Northern and central Alberta, and the western mountains; an isolated population present in the Cypress Hills.

Life History. Terrestrial; active throughout the year; several litters of 2 to 7 or more young born during the summer; gestation period 17 to 19 days (Svihla); nest in a burrow or under a log or other shelter; food green vegetation and seeds.

General. The red-backed mouse is a forest animal, and is one of the commonest of Alberta small mammals, though not as widespread as the deer mouse. In Wood Buffalo Park, Soper estimated from 8,300 to 16,500 of these mice to the square mile. It is probably one of the important food items of such fur bearers as the marten.

Though largely nocturnal, they are frequently seen about by day, and Bailey writes as follows of the rare good fortune he had south of our border in Montana.

"Early one morning, when camped in the Big Snowy Mountains in Montana, I was watching the Pine Squirrels climb to the tallest spruce tops to warm themselves in the first rays of sunlight, when the leaves moved and out came an *Evotomys* (red-backed mouse) only a few feet away.

After eyeing me intently for a moment he began to move about as freely as if I had been a stump. His ears were erect and constantly changing position, his eyes were bright and prominent, and his nose and whiskers were in constant motion. His colour harmonized beautifully with the reddish-brown leaves and the yellow and grey stems of dry grass as he scampered from one plant to another reaching up to bite off the stems, and then hunching himself up in a fluffy, round ball to eat from his hands, while keeping one eye on me." (Bailey)

References

Bailey, 1897: Proc. Biol. Soc. Wash., 11, pp. 113-137 (revision).

Crowe, 1943: Bull. Amer. Mus. Nat. Hist., 80, p. 404 (Rocky Mountains, taxonomy).

Soper, 1942: Jour. Mammal., 23, p. 137.

Short-tailed Meadow Vole. *Microtus pennsylvanicus* Ord

(Also called Meadow Mouse)

Diagnosis. Total length 147-171 mm. (5·7-6·6 in.); tail 36-48 mm. (1·4-1·8 in.); hind foot 18-21; above dark grizzled brown, greyish, and black; below grey. The skull character that is distinctive is the molar pattern, with the small posterior loop on the second (middle) upper molar (*See* Figure 77).

Geographical Variation. In Alberta the northern and western animals are dark; those from the prairies average paler, allowing the two following races to be recognized:

(1) *Microtus pennsylvanicus drummondi* Audubon and Bachman. Total length 147·1 mm.; tail 36; hind foot 18·7 (averages, Jasper specimens); ranges over most of Alberta.

(2) *Microtus pennsylvanicus insperatus* Allen. Total length 171 mm.; tail 47·8; hind foot 20·9 (averages); paler and larger than *M. p. drummond;* ranges in the extreme southeast arid part of the province.

Distribution in Alberta. Widespread.

Life History. Active throughout the year; several litters a year of 4 to 8 young born after a gestation period

of about 20 days, in a nest in a tussock of grass or under some shelter; food largely green herbaceous vegetation, some seeds and some insects.

General. As their name implies, the meadow voles favour grassy places. There they make their little runways and tunnels. If the grass is dense, one may have to bend aside the grass to see them. Where the ground is mossy the little trails leading from burrow to burrow in mossy banks may be conspicuous. And there are additional signs of their occurrence in the little heaps of short lengths of grass at the burrow entrances, or just inside them.

On the arid plains themselves these voles are absent, but where there is water, and consequently green grass, the voles are there, even if it is only an oasis in a thirsty plain.

Where the country is well watered they become common.

Populations of as high as 70,000 meadow voles to the square mile were estimated by Soper in Wood Buffalo Park. However, like so many animals these have their years of abundance and their years of scarcity, and there seems to be a regularity about it, the period from one peak of abundance to the next being about 4 years. For some fur bearers such as the red fox, these voles are very important as food.

References

Bailey, 1900: No. Amer. Fauna, No. 17 (revision).
Bailey, 1924: Jour. Agric. Research, 27, pp. 523-535 (biology).
Hamilton, 1940: Scientific Monthly, 50, pp. 425-434 (biology).
Rand, 1943: Can. Field-Nat., 57, pp. 115-123 (revision, Canadian forms).
Soper, 1942: Jour. Mammal., 23, pp. 137, 138 (Wood Buffalo Park).

Long-tailed Meadow Vole. *Microtus longicaudus* Merriam

Diagnosis. Total length 184 mm. (7 in.); tail 66·3 mm. (2·5 in.); hind foot 20·3 (averages, southeast British Columbia); colour, above grizzled brownish grey and black, below greyish. For tooth pattern *See* Figure 77 and note lack of posterior loop on middle upper molar.

The relatively long tail, about three times the length of the hind foot, and the greyish colour of the fur are rather distinctive external characters.

Geographical Variation. This western species, which includes the forms earlier known as *M. mordax*, is represented by one known subspecies in Alberta:

(1) *Microtus longicaudus vellerosus* Allen. Ranges in the Rocky Mountains.

However, two specimens from the vicinity of the Cypress Hills indicate that a different, isolated population may occur there.

Distribution in Alberta. The Rocky Mountains (common) and the Cypress Hills area (rare).

Life History. Active throughout year; 4 to 6 young in a litter, and several litters a year (Alberta data); probably gestation period of about 21 days as in related forms; food chiefly herbaceous vegetation.

General. At the outlet of Medicine Lake, near Jasper, a great rock slide covered the bottom of the valley, and in places there is much short, dense, green grass. Here meadow vole signs were everywhere; little pathways cut in the grass leading from one rocky shelter to the next; piles of greenish droppings; and little heaps of grass stems cut into short lengths. Here, the mice were active in the open during the morning, apparently trusting to the proximity of cover into which to dart for shelter at the first alarm. Several were seen running about and Howard Clemens watching quietly had one come from under a rock on which he was sitting and look about unconcernedly.

The habits of this vole seem to be much like those of the short-tailed meadow vole, but it is perhaps more common at higher altitudes, and favours drier habitats, though both are sometimes found together in both wet and dry habitats.

Reference

Anderson and Rand, 1943: Can. Field-Nat., 57, pp. 19-21 (revision, Canadian forms).

Chestnut-cheeked Vole. *Microtus xanthognathus* Leach

Diagnosis. Total length 210 mm. (8·25 in.); tail 50 mm. (1·9 in.); hind foot 27 (Bailey); colour above dark grizzled brown and black, sides of nose and ear patch

bright rusty yellow or chestnut. Enamel pattern of molars much as in *M. longicaudus* (Figure 77) but middle loop of last lower molar often divided into two triangles.

The large size (for a vole) and the chestnut colour on the head are distinctive external characters.

Geographical Variation. None recorded.

Distribution in Alberta. The northern part of the province, which is the southeastern limit of its range.

Life History. Probably similar to that of other voles; as many as 11 embryos have been recorded in a pregnant female; food probably green vegetation and bark; Preble records horsetails *(Equisetum)* stems as a favourite food.

General. What we know of this northern woodland vole can be put in a few words. In the National Museum we have only two specimens, both taken by Dr. M. Y. Williams in his northern travels. Soper trapped in vain for it in Wood Buffalo Park, and yet years before, when Preble was on the Athabaska, he found a colony near Fort Smith and took twenty adults there. "This colony inhabited a strip of young mixed woods bordering a marsh about half a mile south of the post. The burrows of the animals were in dry ground in the woods or shrubbery, and evidently were quite deep, as I saw nearly a bushel of dirt at the entrance of a single burrow. From the burrows their well-trodden runways extended in various directions to a distance of 50 to 75 yards, only rarely reaching wet or even damp ground. As a rule only a pair was taken in one set of runways." (Preble)

In regard to another colony on the Athabaska, 30 miles above Pelican Portage, Preble writes, "It must have comprised many thousands of individuals, and occupied a heavily wooded area at least half a mile square, on the gently sloping sides of a valley."

Evidently the species fluctuates greatly in numbers, and some student in the future may find them common.

Reference

Preble, 1908: No. Amer. Fauna, No. 27 (habitat, Wood Buffalo Park area).

Richardson Vole. *Microtus richardsoni* DeKay

Diagnosis. Total length 248·8 mm. (9·7 in); tail 74·2 mm. (2·9 in.); hind foot 27·9 (averages, Alberta); above grizzled greyish, brown, and black, below greyish; skull very angular and spreading, with enamel pattern of molars much like that of *M. longicaudus* (Figure 77).

The large size is distinctive; the spreading, angular skull is also diagnostic (Figure 80).

Geographical Variation. This species of the western mountains has several subspecies recognized, but only one occurs in Alberta:

(1) *Microtus richardsoni richardsoni* DeKay.

Distribution in Alberta. Higher altitudes in the Rocky mountains.

Life History. Four to 8 young in a litter; more than one litter a year; food probably largely herbaceous vegetation.

General. This giant meadow mouse is an animal of higher mountain streams. Hollister writes of one colony on the headwaters of Smoky River. They were found to inhabit the banks of a glacial stream just below timberline. The underground tunnels and runways were all close to the streams and were evidently filled with water at times. The burrows were of large size, the lateral surface openings often being 5 to 6 inches in diameter, and were placed in thickets of alder and willow. A few large, well-defined surface runways were also seen. Small heaps of fresh cuttings of plants, chiefly the stems and tops of blue lupine were found in the runways.

References

Hollister, 1912: Can. Alpine Jour., Special number, pp. 24, 25 (habitat, Jasper area).

Anderson and Rand, 1943: Can. Field-Nat., 57, pp. 106, 107 (review of Canadian forms, breeding data).

Upland Vole. *Pedomys minor* Merriam

Diagnosis. Total length 128 mm. (5 in.); tail 30 mm. (1·1 in.); hind foot 16·7 (averages, North Dakota, Bailey); colour above grizzled, uniform, clear, peppery

grey from a combination of black and whitish tipped hairs; belly washed with soiled white or pale buffy; tail sharply bicoloured; dusky above, buffy below; feet grey (Bailey), slightly browner in summer; young darker; skull high and narrow; enamel pattern of molars (Figure 77) with the last upper molar with only two closed triangles as in the following species (instead of three as in the preceding forms) and the first lower molar with three closed triangles and two open triangles (instead of five closed triangles as in the preceding and following forms); the last lower molar usually has three transverse loops as in preceding forms, but occasionally there are two transverse loops and a median pair of triangles as in the following species.

Size and colour are good characters for recognition.

Geographical Variation. None recognized.

Distribution in Alberta. The southeast part of the province, north to Edmonton.

Life History. About 6 young in a litter; probably several litters a year; food probably largely herbaceous stems and leaves and some roots and bulbs (Bailey); store food (Criddle).

General. Although abundant at times, the upland vole is local in occurrence. In habitat it prefers dryer grasslands than does the short-tailed meadow mouse, and it seems to live more in burrows than does the latter. Soper writes that in places the loose groups of little burrows that may number up to a dozen or more may be in scant grass that furnishes it little or no protection, and the well beaten runways connecting the burrows and leading off to feeding grounds in denser grass are conspicuous. Frequently, he writes, it was possible to stand in the midst of a colony and easily trace with the eye their little worn runways to distances of 10 and 15 feet, so evident were they. As with some others in this group of voles, they seem to be nearly as active by day as by night.

Criddle, in Manitoba, found that the least weasel was one of the important enemies of the upland vole. Three mouse homes that were under observation were taken possession of during the winter by least weasels and the

inhabitants quickly destroyed; in one such weasel-preempted mouse nest there were found in April six dead upland voles. The homes of twenty-seven mouse communities were examined at this time, and all were found to have been entered by weasels, the mice having been killed and partly eaten in each instance. And here we see one factor at work reducing a large mouse population. For Criddle writes, "From being an abundant animal the species was reduced to insignificance in the course of a few weeks."

References

Bailey, 1926: No. Amer. Fauna, No. 47 (habits in North Dakota).
Criddle, 1925: Can. Field-Nat., 39, p. 145 (habits in Manitoba).
Soper, 1927: Manuscript notes.

Pallid Vole. *Lemmiscus curtatus* Cope

Diagnosis. Total length 128 mm. (5 in.); tail 20; hind foot 18 (Soper, southern Alberta and Saskatchewan averages); colour above pale buffy or ashy grey, whitish below; skull flat and wide; in enamel pattern of molars note the last upper molar with two closed triangles; first lower molar with five closed loops, and last lower molar with two transverse loops and a pair of median triangles (Figure 77).

Size, colour, and short tail, about length of hind foot, are good characters for identifying this species.

Geographical Variation. This is a species largely of the western United States; intruding into the southern Canadian prairies, where the subspecies represented is:

(1) *Lemmiscus curtatus pallidus* Merriam.

Distribution in Alberta. The arid plains of the southeast, north to Calgary (Bailey).

Life History. Several litters of about 5 young a year (Saskatchewan data, Soper); food, sage bush leaves and other herbaceous matter; and in Saskatchewan chiefly "rabbit-bush" (*Chrysthammus graveolus*) (Soper).

General. Up until 1927 the National Museum had only three fragmentary specimens of this species; one had been taken from the nest of a long-eared owl; one from the

talons of a pigeon hawk; and one from the entrance of a burrowing owl's burrow. Then Soper, studying the mammals of the plains, collected thirty-nine of them for us.

Soper found it in the treeless area of the semi-arid, short grass plains, scattered over with small cacti and sage brush. Its presence was easily detected; its little burrows about the roots of sage bushes, and well trodden trails over the sun-baked land were conspicuous. It was extremely local in distribution, however, and only here and there were these little colonies found. In each of these the number of burrows and the runways would have led one to believe that a large number of mice were active there, but each time only one adult female with a number of young, presumably from earlier litters, were taken in each colony.

References

Soper, 1931: Can. Field-Nat., 45 pp. 209-214 (habitat and habits in Saskatchewan).

Hall, 1928: Jour. Mammal., 9, pp. 201-204 (summary of habits).

Muskrat. *Ondatra zibethica* Linnæus

Diagnosis. Total length 496-530 mm. (19·5-21 in.); tail 232-240 (9-9·4 in.); hind foot 73·5-74·5 (2·8 in.); colour above brownish black; below paler; tail about as long as head and body, much compressed; hind foot enlarged, not webbed, but with a fringe of hair to aid in swimming.

The size and shape of the tail are distinctive.

Geographical Variation. This species, ranging from Nova Scotia to British Columbia varies enough to enable several races to be recognized, of which the two following occur in Alberta.

(1) *Ondatra zibethica spatulata* Osgood. Total length 530 mm; tail 232; hind foot 74·5 (averages, Hollister); of north and central Alberta.

(2) *Ondatra zibethica cinnamominá* Hollister. Total length 496 mm.; tail 240; hind foot 73·5 (averages, Hollister); a smaller, paler form (also with skull differences) of the waterways of the southern plains.

Distribution in Alberta. Throughout the province where suitable marshes occur; very local, but occurs even in the arid plains of the southeast.

Life History. Aquatic; largely nocturnal, and crepuscular; makes houses, or burrows with underwater entrances; two or more (?) litters a year of about 6 young each (in northern United States); food, herbaceous vegetation of the marsh and its edges.

Figure 81. Muskrat.

General. The muskrat is an overgrown meadow mouse that has taken to living in the water. With a thick, waterproof coat, enlarged hind feet for swimming, and a long, compressed tail to use as an oar or a rudder, it is well fitted for its aquatic existence.

As dusk approaches, it emerges from its daytime retreat, in a hole in a bank, or in the mound-shaped house it has made out in the marsh. If a person sits quietly on the bank the muskrats will swim by within a few yards, and perhaps even climb out on the bank to feed, like gigantic meadow mice in shape.

The muskrat's fur, though fitting it for its environment, nevertheless has its drawbacks for a muskrat, for it is prized for human wear too.

Muskrats are prolific animals and able to stand a great deal of trapping. But adverse factors, such as the drying up of waterways and lakes, may wipe them out over considerable areas as at Islay (Soper) and as happened in Manitoba. Reclamation projects, and marsh management such as those in Manitoba (Allen, Stevens) have resulted in turning dried out, unproductive waste lands back into productive marshes, where populations of fifteen muskrat to the acre have been built up, and the average yield is four 'rats to the acre (Allen). This was on large areas of over 50,000 acres. On smaller areas, in Ontario, the yield has been higher. On a Lake Saint Claire marsh where about 1,200 acres are intensively managed, the yield is about eight muskrats to the acre, which apparently is exceeded by few areas in the United States. It is interesting in this connection to mention that on the Lake Saint Claire marsh, the average number of muskrats to each muskrat house was 2·7.

In Minnesota a study by McCann indicated that though most female muskrats bore about twelve young a year, only about half of these lived to trappable age. He further found that a reduction by trapping (in December) of not more than 50 per cent of the population was safe.

In a study by Elton, it is shown that considering Canada as a whole, since about 1850 there has been a strongly marked cycle in numbers of muskrats, with an average period of recurrence of about 10 years. The peak years since the beginning of the present century, according to this study, are 1900-01; 1912; 1921-1922; 1928-33. However, the period of abundance in northern and southern Alberta did not always coincide.

The total annual value of the muskrat taken from Alberta in the period 1919-20 to 1941-42 has varied between $135,514 and $888,640; the annual average value per pelt has varied from $0.40 (1931-32) to $2.08 (1941-42).

The Alberta muskrat yield in as follows:

Year	No. of pelts	Year	No. of pelts
1919-20	298,783	1931-32	512,977
1920-21	413,612	1932-33	555,391
1921-22.....	.....	1933-34	544,808
1922-23	735,653	1934-35	404,428
1923-24	331,144	1935-36	397,029
1924-25	271,633	1936-37	274,640
1925-26	310,714	1937-38	199,285
1926-27	306,499	1938-39	237,224
1927-28	300,015	1939-40	391,770
1928-29	537,556	1940-41	328,757
1929-30	274,811	1941-42	250,845
1930-31	510,036		

But the muskrat is not always a welcome addition to ponds and waterways. Where irrigation is practised, and water held by earthen dams, as in parts of southern Alberta, the muskrat burrows damage the installations and the presence of the muskrats can not be tolerated.

References

Allen, 1942: Trans. Seventh No. Amer. Wildlife Confer., pp. 263-271 (Manitoba's marsh and muskrat management).

Elton and Nicholson, 1942: Jour. Animal Ecology, 11, pp. 86-126 (fluctuations in Canada).

Hewitt, 1942: Trans. Seventh No. Amer. Wildlife Confer., pp. 277-283 (muskrats and marsh management in Ontario).

Hollister, 1911: No. Amer. Fauna, No. 32 (revision).

Johnson, 1925: Roosevelt Wildlife Bull., vol. 3, pp. 199-320 (life history, New York).

McCann, 1944: Jour. Mammal., vol. 25, pp. 59-63 (Minnesota; weights; age and sex; possible harvest).

Stephens, 1945: Can. Geog. Jour., 30, pp. 11-19 (a popular account of Manitoba's muskrat-marsh reclamation policy).

FAMILY—MURIDAE. OLD WORLD RATS AND MICE

The centre of abundance of this group is southern Asia. The entire group of a great many species (there are more than 500 named forms listed in the genus *Rattus* alone, according to some authors) was originally completely Old World in distribution, but three species have been brought to Canada by man's activities: the Norway or house rat, the black rat, and the house mouse. Of these,

two have reached Alberta. These live in and about buildings, are prolific, bearing several litters of young during the year, in a nest in some sheltered place. The young are blind and naked at birth. Their food is whatever man leaves available, and by destroying or soiling foodstuffs and other merchandise these animals may do considerable damage. There is also the possibility of their carrying disease.

Brown Rat. *Rattus norvegicus* Linnaeus

(Also called Norway Rat, House Rat)

Diagnosis. Total length 407 mm. (16 in.); tail 175 mm. (6·8 in.); hind foot 41 (adult male from Quebec); tail long and scaly; fur coarse; colour above grizzled grey; below grey.

The size, and the practically naked, hairy tail are distinctive.

Geographical Variation. Several subspecies have been described in the Old World. Presumably the form introduced into eastern Canada is from Europe; that into western Canada could perhaps be from the Orient. Present material available makes it unprofitable to go into the question.

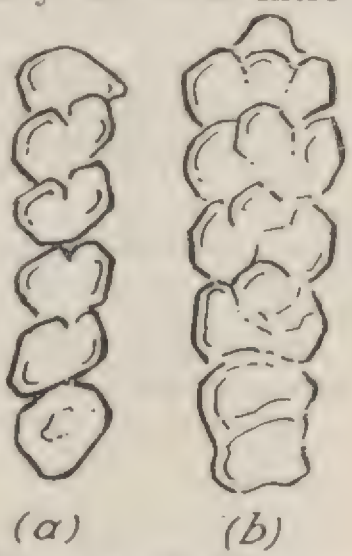

Figure 82. Upper molars of: (*a*) white-footed mouse showing tubercules in two rows; and (*b*) house rat showing tubercules in three rows.

Distribution in Alberta. Recorded from Edmonton and Camrose; likely to occur in other cities; apparently not well established.

Life History. Several litters of up to 12 young each born after a gestation period of 21 to 22 days (Kenneth); food, vegetable or animal food used by man and available in storage or as discarded matter.

General. The brown rat competes directly with man for food, in a brigandish sort of way, and fairly successfully; it is extremely difficult to control; and when attacked it defends itself savagely. Bailey has summed up

their traits as " . . . sly, filthy habits, mean appearance, and vicious disposition . . ." There is also the probability of conveying disease.

Be that as it may, the brown rat and its smaller relative, the house mouse, are thoroughly disliked. And one result is that all animals bearing the name either "rat" or "mouse" have the same stigma automatically transferred to them. If only the native small rodents, graceful in form and beautiful in colour, had other names than rats and mice, they undoubtedly would seem more attractive and be better known, despite most of them being shy, nocturnal creatures not easy to know.

To return to our brown rat; on purely economic and health grounds, it can not be tolerated, and every effort should be made to keep this invader from becoming established. However, this group of rats has been very useful to man. The ordinary white rats, kept as pets and used in experiments in applied biology, feeding, and medical studies, are albinos of related species.

References

Lantz, 1909: The Brown Rat in the United States, U.S. Biol. Surv., Bull. No. 33.

Silver, 1941: U.S. Dept. Interior, Fish and Wildlife Service, Wildlife Circular No. 6 (a summary of habits, economic status, and control).

House Mouse. *Mus musculus* Linnaeus

Diagnosis. Total length 185 mm. (7·7 in.); tail 97 mm. (3·8 in.); hind foot 26 (adult male from Nova Scotia); ears and eyes fairly large; tail practically naked; colour above grizzled greyish brown, below brownish grey.

The grizzled brown colour above, and the brownish grey underparts are fairly good external characters in distinguishing this species from the white-footed and deer mice that are most likely to be confused with it in this area.

Geographical Variation. Many forms of house mouse have been described; for a discussion of the forms imported into America *See* Schwartz and Schwartz. 1943, Jour. Mammal., vol. 24, pp. 59-72.

Distribution in Alberta. Established in the central part of the province at least.

Life History. Several litters of about 5 young born yearly, in a nest in some sheltered place, usually in buildings; gestation period about 20 days.

General. The house mouse is a widespread species in parts of the Old World, with some forms that live in close association with man, and with others that do not. It was brought to America in ships, and travelling in goods, has now become widespread. In central Alberta at least the species is established in settlements and has been found a short distance from human habitations in grassy meadows and aspen groves.

In houses they are a nuisance, gnawing and destroying foodstuffs, clothing, and bedding, and gnawing holes Usually their ravages are easily controlled in houses by the use of a few mouse traps.

The white mice kept as pets are albinos of this species.

References

Hall, E. R., 1927: Univ. Cal. Pub. Zool., 30, pp. 189-203 (outbreak in California, rate of increase, etc.).

Schwartz and Schwartz, 1943: Jour. Mammal., 24, pp. 59-72 (geographical variation).

FAMILY—ZAPODIDAE. JUMPING MICE

This family has been united with that of the true jerboas of Africa, but the latter are more specialized jumping rodents, and the Zapodidae is better kept as a separate family with representatives in the northern part of the Old World, and in North America. It is not numerous as to species. The distribution of the subfamily Zapodinae, to which our species belong, is peculiar; there are two genera in North America, and related forms in China.

These mice, with long hind legs and very long tails, are jumping animals of grassland and forest.

Preble writes that the statements of earlier writers that these animals leap 4 or 5 yards is exaggeration, but they do possess remarkable leaping powers, and when disturbed will leap 6 or 8 feet. He goes on to say that

these mice do not follow beaten runways, as do many small mammals, but seem to wander rather indiscriminately, availing themselves to some extent of natural pathways and open places. However, they are sometimes taken in meadow mouse runways, and when travelling slowly do not take long hops.

Figure 83. Jumping mouse; the insert shows the grooved upper incisors.

These animals hibernate during the winter, usually in underground nests, and the undeveloped young are born in such nests, though grass nests are sometimes built in the grass, usually in late summer.

The habitat of jumping mice is either rich grassland or forest, apparently the vicinity of water is necessary, and some of them at least are not adverse to swimming (Davis, and personal record).

The food of these animals is largely vegetable seeds, succulent grasses, and fruits, but some insect matter is eaten.

In Alberta are two species that seem to replace each other geographically.

KEY TO ALBERTA SPECIES

(This is only suggestive, *See* page 188 for comparisons.)

(1) Total length 219 mm. (8·5 in.) or over, skull more robust with heavier molars and larger incisive foramen—western jumping mouse (*Zapus princeps*)

(2) Total length 212 mm. (8·2 in.) or under, skull less robust, with lighter molars and smaller incisive foramen—Hudsonian jumping mouse (*Zapus hudsonicus*)

Meadow Jumping Mouse. *Zapus hudsonicus* Zimmerman

Diagnosis. Total length 212 mm. (8·2); tail 126 mm. (4·9 in.); hind foot 29 mm. (1·1 in.) (Wood Buffalo Park specimen, Soper); tail longer than head and body; hind foot very long; colour, back grizzled brown, sharply contrasting with tawny sides; underparts creamy white; skull light and slender, with light molars and small incisive foramen (Figure 84).

The long tail and long hind foot will distinguish this species from all similar sized rodents except the next, which see for comparisons.

Geographical Variation. This species ranges from Nova Scotia to Alaska and has a number of recognized forms, of which only one occurs in Alberta as follows:

(1) *Zapus hudsonicus hudsonicus* Zimmerman.

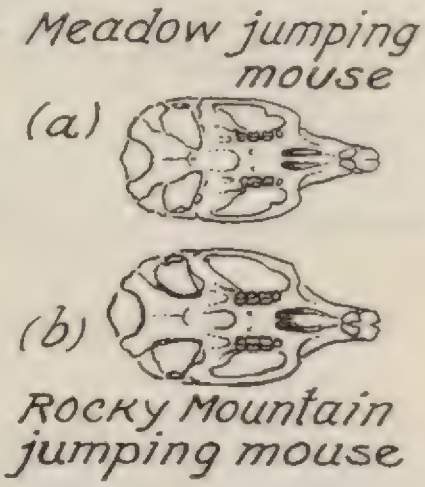

Figure 84. Skulls of two species of jumping mouse.

Distribution in Alberta. The northern part of the province.

Life History. Hibernates; one or perhaps two litters of 3 to 6 young a year; food succulent grasses, fruits, seeds, and some insects.

General. Preble found a few jumping mice, in what is now Wood Buffalo Park, in shrubby woods bordering a marsh. There, one afternoon he watched one for some time hopping about in some willows. It moved quite leisurely, making jumps of only 2 or 3 feet. However, Soper found the species very scarce when he visited the area years later.

References

Hamilton, 1935: Amer. Midl. Nat., 16, pp. 187-200 (habits).
Preble, 1899: North Amer. Fauna, No. 15 (revision).

Rocky Mountain Jumping Mouse. *Zapus princeps* Allen

Diagnosis. Total length 219-240 mm. (8·5-9·4 in.); tail 130-144 mm. (5·1-5·6 in.); hind foot, 30-31 mm. (1·1-1·2 in.); modified for leaping, with long hind foot and long tail; colour, a dorsal stripe of grizzled brown, contrasting with buffy or ochraceous sides; belly white; skull robust, with heavy molar teeth and large incisive foramen (Figure 84).

The long tail, hind foot, and colour pattern will separate this from all but the Hudsonian jumping mouse. From this last it is separable by its usually larger size, and more decisively by the larger, more robust skull, with heavier molar teeth and larger incisive foramen (Figure 84). *Princeps* is also slightly darker above and less richly coloured on the sides than in *Zapus hudsonicus*.

Geographical Variation. Of the several forms of this western species two are represented in Alberta:

(1) *Zapus princeps idahoensis* Davis. Total length 240 mm.; tail 144; hind foot 31 (Davis); the mountains north at least to Jasper Park.

(2) *Zapus princeps minor* Preble. Total length 219·6 mm.; tail 130·7; hind foot 30·1 (averages, Saskatchewan and Alberta, Soper); a smaller, paler animal of the plains, recorded north to Entrance (Crowe).

Distribution in Alberta. The southern part of the province and the mountains of the west.

Life History. Hibernates; probably a single litter of 4 to 8 young a year; food probably chiefly small seeds and some fruit.

General. "Aside from *Microtus mordax*, the long-tailed vole, we found the jumping mouse the most common mouse of the open meadow country above timberline. While hunting ptarmigan in the open meadows of the Moose Pass country we sometimes startled jumping mice in the grass. When frightened in this manner the animals sometimes jump five or six feet at a single bound." (Hollister)

As well as living above timberline, it is common in glades in the forest, and in the edge of the mountains

where forest gives way to plains; out on the plains country itself, however, this jumping mouse is uncommon, according to Soper, and probably only occurs where there is water and tall grass.

References

Davis, 1934: Jour. Mammal., 15, pp. 221-227 (taxonomic).
Hollister, 1912: Can. Alpine Jour., special number, pp. 26, 27 (occurrence, Jasper area).
Preble, 1899: No. Amer. Fauna, No. 15 (summary of habits, revision).

FAMILY—ERETHIZONTIDAE. NEW WORLD PORCUPINES

This family has its home in the New World tropics, sending only one species northward as far as the United States and Canada. In the Old World are porcupines but they belong to a different, though related, family, and their spines are much longer (but not nearly as effective weapons) than those of the New World porcupines.

Most of the New World porcupines are arboreal; some have prehensile tails. The most striking thing about them is their spines, that are plentifully mixed in their dorsal pelage. The belief that porcupines shoot their quills is an ill-founded one. It does not shoot its quills. But the quills are effective armour. They are lightly attached to the skin, are sharp and barbed. The Canadian porcupine, when attacked, turns its back to its foe and erects its spines. If an incautious dog seizes it, the dog's mouth is liberally filled with the sharp spines. And yet it may be in danger before it touches the porcupine; for the latter sensing the approach of an enemy, may suddenly swing its muscular, well armed tail and plant a number of quills in the incautious intruder. Some animals, however, have learned to kill porcupines, notably the fisher and the cougar, and the wolf, the bear, and others occasionally kill and eat them.

Canadian Porcupine. *Erethizon dorsatum* Linnaeus

Diagnosis. Total length about 800 mm. (31·4 in.); tail about 230 mm. (9 in.); hind foot about 115 mm. (4·5 in.). A stout bodied animal with a short stout tail; short legs; plantigrade feet; and long, strong, curved claws; dorsal

pelage thickly mixed with barbed spines; underparts thinly haired; colour above varies with the subspecies and also individually; above generally blackish with many of the long guard hairs tipped with whitish or some shade of yellowish; the amount of this light tip very variable; some specimens appear mostly yellowish, some mostly blackish (racial and other (?) factors are correlated with this); quills white, more or less black tipped; colour of underparts blackish or brownish.

Geographical Variation. This species ranges from Nova Scotia to Yukon, and several races are recognized by a combination of skin and skull characters, of which the following three are represented in Alberta:

(1) *Erethizon dorsatum myops* Merriam. Total length 800 mm.; tail 220; hind foot 114 (Alaska males); this form has the general colour brownish, rather than blackish; some animals are quite blackish in appearance, others yellowish; the yellow is rusty yellow; northern Alberta (at present only one specimen, from Wood Buffalo Park available for identification, and it is this form with a tendency toward the eastern subspecies, *E. d. dorsatum*. More material, both skins and skulls are needed).

(2) *Erethizon dorsatum nigrescens* Allen. Total length 802 mm.; tail 240; hind foot 116 (British Columbia male); general colour more blackish than in *E. d. myops* and animals with a more orange-yellow, less rusty yellow tinge to the yellowish tipping, and this yellow of only moderate extent; there is less variability in this form than in *myops* (there are also good skull characters); inhabits the mountains of the west.

(3) *Erethizon dorsatum epixanthum* Brandt. Like *E. d. myops*, but with yellow in pelage greenish yellow rather than rusty yellow. Inhabits the plains; additional specimens needed.

Distribution in Alberta. Over most of the province, but local in the plains of the southeast.

Life History. Arboreal and terrestrial; largely nocturnal; sleeps both in trees and in caves; 1 or sometimes 2 young born after a gestation period of about 6 to 7

months (Taylor, who questions Struthers data that 16 weeks is the gestation period); young well developed at birth and active soon after; quills soft at birth but harden on exposure to air; may suckle for 7 weeks, but weaning begins very early (Taylor).

Figure 85. Canada porcupine studies show: (a) a quill; (b) base and barbed tip, enlarged.

General. The porcupine is an unfortunate creature. With a well developed coat of spines that has afforded him protection from many enemies, a food supply that is always available summer and winter, and an amazing indifference to climatic changes, he should be one of the

happiest of all our woodland creatures. Yet he is a solitary creature without friends. For a short time in the autumn, during the mating season, males and females come together; in the spring the young accompanies the mother but it is quickly weaned and soon leaves her. For the rest of the year the animals are solitary.

To his human neighbours his name is anathema; he eats the bark of trees, to the foresters' alarm; he chews up the packers' saddlery, and in and about camps he chews up installations and boxes to the disgust of the woodsman. He has no beauty of manner or grace of movement; no winning way to endear him to the heart of the sentimentalist.

He does have some good qualities, nevertheless, and these are not only the purely economic ones of being a source of food to some Indians (Hollister); a potential source of food to a lost woodland wayfarer, and a source of supply of porcupine quills for decorating buckskin. As Taylor writes, "The porcupine is an asset for its bizarre appearance and unusual habits. If it were an unknown exotic we would go to great lengths to keep it in our zoological gardens, even at considerable cost for its capture, transportation and care. Why should we not be willing to sacrifice a little timber for the sake of maintaining this naive woods creature in localities where it is not doing appreciable damage." As Bailey says, "Porcupine blazes and an occasional porcupine along the way help to make the forest interesting."

References

Anderson and Rand, 1943: Can. Jour. Research, vol. 21, pp. 292-309 (geographical variation in Canada).

Taylor, 1935: Univ. of Arizona, Biol. Sci., Bull. No. 3, 177 pp. (monograph on habits).

ORDER—LAGOMORPHA. HARES AND THEIR RELATIVES

The mammals in this order were at one time included in the rodents, but in addition to the evident character of having an extra pair of incisors in the upper jaw they also have good anatomical differences.

SYNOPSIS OF FAMILIES IN ALBERTA

(Based on species in the province)

Family 1—*Ochotonidae.* Pikas. Small size (length about 170-200 mm.) (6·6-7·8 in.); ears broad but not greatly elongated; hind legs about same length as forelegs (p. 193).

Family 2—*Leporidae.* Rabbits and Hares. Size medium (length about 380-600 mm.) (14·9-23·6 in.); ears very long; hind legs much longer than forelegs (p. 196).

Figure 86. (*a*) white-tailed jack rabbit; (*b*) snowshoe rabbit; (*c*) cottontail rabbit; (*d*) pika.

FAMILY—OCHOTONIDAE. PIKAS

This family is more plentiful as to species in the Old World, in Asia and extreme eastern Europe, than in the New World where only three species are found. In the New World, pikas are found only in western North America, from Alaska to southern California.

In America they are variously called pikas, rock rabbits, and conies. The name coney is also applied to the English rabbit and to hyrax, and it seems better not to use it for these animals. The word pika, which has been in common use in Europe for some species of this

family, is much to be preferred; it is from the vernacular of the Tunguses — a tribe living in northeastern Siberia (Howell).

The three species that occur in North America are geographical representatives of each other.

In Alberta there is only one species.

Pika. *Ochotona princeps* Richardson

(Also called Rock Rabbit, and Coney)

Diagnosis. Total length 177-191·6 mm. (6·9-7·5 in.); hind foot 29·4-30·5 mm. (1·1-1·2 in.); colour above pinkish or brownish grey, grizzled with black, more grey posteriorly; ears dusky, margined with whitish; underparts whitish.

The size, low broad ears, and lack of an external tail are distinctive.

Geographical Variation. This is a species of the mountains of western United States and Canada and many races are recognized, of which three are represented in Alberta, according to Howell, though Crowe shows the races are not well defined in this area. The following is Howell's treatment:

(1) *Ochotona princeps princeps* Richardson. Total length 191·6 mm; hind foot 30·5 (averages, Jasper area, Howell); in the Rocky Mountains in the Jasper area.

(2) *Ochotona princeps lutescens* Howell. Total length 177 mm.; hind foot 29·4 (averages, Canmore, Howell); similar to *O. p. princeps* but smaller and decidedly paler; in the Banff area.

(3)*Ochtona princeps levis* Hollister. Total length 183 mm.; hind foot 30·5 (averages, Waterton Lakes, Howell); like *O. p. lutescens* in size, but darker and more buffy in colour (Howell); in the Waterton Lake area.

Distribution in Alberta. In the Rocky Mountains.

Life History. Active year round; diurnal; terrestrial; living in rock slides; 3 to 4 young (Colorado); food herbaceous vegetation and leaves of shrubs; stores food.

General. Rock slides are the favourite homes of the pika, whether the rock slides are high above timberline, or low in the forest. Pikas are to be found in at least one of the rock slides that reaches Waterton Lake. Often the first suggestion one has of their presence is their little bleating cry, perhaps coming from the depth of a rock slide beneath one's feet. If the intruder withdraws, and sits quietly watching, he may see the pika come up and perch motionless on top of some boulder, where it harmonizes so well with its surroundings that it takes a keen eye to pick it out. Every now and then it may raise its head to give voice to its little "eek" or bleat. Finally, reassured by the intruder's stillness it may go scampering about over the rocks with a half-hopping, half-running gait that suggests a cottontail, and recalls the pika's relationship with the rabbits.

But if the pika does not come out of its rocky retreat soon, it can often be enticed out by making a squeaking noise, such as that produced by pressing the lips against the back of the hand, and drawing in the breath sharply. Soon the pika answers, and in a few minutes may be sitting on the top of a boulder within a few yards of one.

Even if pikas can not be seen or heard, evidence of their occurrence is often conspicuous in the form of their little haystacks (not to be confused with pack rat caches) tucked under the shelter of some rock, or in the presence of their droppings; little, rounded, hard pellets about the shape and size of B.B. shot.

The haystacks are perhaps the most unusual things about the pikas. In late summer and autumn they gather quantities of herbaceous plants and twigs of shrubs, and store them under rocky projections, where they dry, are safe from the weather, and are presumably the animal's supply of food for the winter.

References

Howell, 1924: No. Amer. Fauna, No. 47 (revision).

Martin, 1943: Jour. Mammal., 24, pp. 394-396 (habits, weights, etc., in Colorado).

FAMILY—LEPORIDAE. RABBITS AND HARES

Rabbits and hares are found naturally in most parts of the world except the Australian area, into which common rabbits from Europe have been introduced; absent from Madagascar.

They are terrestrial animals that travel by a series of leaps; they are sometimes seen abroad by day, but are more active in the twilight, and at night. They are active throughout the year. Their food is vegetable: herbaceous material, bark, and twigs, varying with the season. The upper grinding teeth are farther apart than the lower grinding teeth so that these animals chew with a sideways movement of the lower jaw. Some northern species change colour from white in winter to brown in summer.

The young of hares are well developed at birth, covered with fur, and soon active; the young of rabbits are born in an undeveloped, naked, helpless state. Hares usually stay above the ground, at most resting in a "form"; rabbits customarily burrow or take shelter underground.

The members of this family are of considerable importance, as food, as sport, as furnishers of pelts for fur and for the making of felt, and as an important item in the process of turning vegetation into flesh for the use of carnivorous animals, including some valuable fur bearers.

Since the discovery of tularemia among rabbits has shown the danger to human beings of this disease, special care should be exercised in handling any rabbits. Examination of the liver and other internal organs of the rabbits will usually show if they are healthy and suitable for food. Thorough cooking should be ensured to render rabbit meat safe as a food (Bailey, 1936).

The domestic rabbit is derived from the common wild rabbit, *Oryctolagus cuniculus* Linnaeus, of southern Europe and North Africa.

In Alberta there are three species of this family.

KEY TO ALBERTA SPECIES OF RABBITS AND HARES

(1) Pelage white (winter pelage) 2
(1a) Pelage brown 3
(2) Ear over 90 mm. (3·5 in.) long, from notch—white-tailed jack rabbit (*Lepus townsendi*)
(2a) Ear less than 70 mm. (2·7) in. long, from notch—snowshoe hare (*Lepus americanus*)
(3) Upper surface of tail white—white-tailed jack rabbit (*Lepus townsendi*) (summer)
(3a) Upper surface of tail brownish or blackish 4
(4) Hind foot less than 100 mm. (39 in.)—cottontail rabbit (*Sylvilagus nuttallii*)
(4a) Hind foot more than 120 mm. (4·7 in.)—snowshoe hare (*Lepus americanus*) (summer)

Snowshoe Hare. *Lepus americanus* Erxleben

(Also called Snowshoe Rabbit, Varying Hare, Bush Rabbit)

Diagnosis. Total length 436-489 mm. (17·1-19·2 in.); tail 41-43 mm. (1·6 in.); hind foot 133-147 mm. (5·2-5·7 in.); ear from notch, 62-67 mm. (2·4-2·6 in.); colour in winter, white with black tips to the ears; colour in summer, grizzled brownish above; tail above blackish; chin white; throat brownish or buffy; under side of body and tail white.

The size; blackish upper side of tail; and back of neck being about same colour as back, not contrastingly rufous, are distinctive characters.

Geographical Variation. The species ranges from Nova Scotia to British Columbia, and a number of races are recognizable, of which four are represented in Alberta, as follows:

(1) *Lepus americanus americanus* Erxleben. Total length 470 mm.; tail 43; hind foot 133; ear from notch, 62 (averages, Nelson); in the central part of the province.

(2) *Lepus americanus macfarlani* Merriam. Total length 489 mm.; tail 42; hind foot 147; ear from notch 67 (averages, Nelson); a lightly defined race, characterized by being larger in size and darker in colour; occurs in the northern part of the province.

(3) *Lepus americanus columbiensis* Rhoads. Total length 436 mm.; tail 41; hind foot 135; ear from notch 66 (averages, Nelson); a small form with large ears and hind feet, and in summer pelage with a distinctive dingy yellow colour to the body (Nelson); in the Banff and Jasper areas of the Rocky Mountains.

(4) *Lepus americanus bairdi* Hayden. Total length 459 mm.; tail 39; hind foot 146; ear from notch 70 (averages, Nelson); size nearly the same as in typical *americanus* but ears and hind feet longer; colour in summer less iron grey and more dusky or dusky reddish brown (Nelson); in extreme southwest Alberta.

Distribution in Alberta. Over the wooded and brush areas of the north and central parts of the province, the mountains of the west and southwest, and an isolated population in the Cypress Hills.

Life History. Terrestrial; crepuscular and nocturnal; young well developed and fur covered at birth and active soon afterwards; three to perhaps five litters of young yearly; young, 1 to 8 (average 3·4 per litter); gestation period about 30 days (Criddle), 38 days (Lyman); young suckled 2 weeks or longer (Criddle); food in summer, herbaceous vegetation; in winter a great variety of twigs and bark.

General. Snowshoe hares reach the peak of their cycle of abundance about every 10 years. Soper writes of one such period in central Alberta. "October had come without snow. The rabbits had already, wholly or in part, donned their snow-white livery of winter, and were consequently very conspicuous against the mellow brown of the autumn woods. At every turn during my ramble they popped up here and there and scurried for fresh cover. Not only in singles. . .but often two's and three's started up. . .scarcely has one received the impression of the previous fleeing object than perhaps another startlingly rockets out from nearly underfoot, stirring up several more . . . " After a preliminary dash, alarm gave place to curiosity and the rabbits stopped to look about. "They appear bold or indifferent because of their very numbers."

In the Rocky Mountain region on Hay River Soper built a cabin in 1913, and had a truly notable visitation of rabbits to his camp clearing. "As dusk descended rabbits came....from every direction....One sparkling moonlight night they visited the clearing in unusual numbers....All seemed imbued with a spirit of festive joviality, doubling about with playful pranks and short sallies. Some fed, some frolicked as games of tag, but a rigid alertness never for a moment ceased. Always one or more of the company sat erect on its haunches, alert, ears forward, nose aquiver, sifting the implications of the night. One ominous sound or sign was enough to scatter this merry assemblage . . . At one time we counted twenty-five in easy view; double that number were possibly present."

It is very different in years of scarcity; then one may walk for hours, or even days, without seeing a rabbit, while everywhere signs and gnawed branches testify to their earlier abundance.

The question of how the brown summer coat changes to the white winter coat is one that has been much discussed, but recent studies by Lyman have definitely shown that the brown coat is shed and is replaced by a white one in the autumn; and in the spring the white coat is shed and a new brown one replaces it.

In recent years rabbit skins have had a small value on the fur market, and many have been taken; the flesh of the snowshoe rabbit is used by woodland dwellers, especially by Indians, as food for humans and food for dogs.

References

Chitty and Nicholson, 1943: Can. Field-Nat., 57, pp. 64-68 (annual report on censuses in Canada with references to earlier reports).
Criddle, 1938: Can. Field-Nat., 52, pp. 31-40 (life history, Manitoba).
Lyman, 1943: Bull. Mus. Comp. Zool., vol. 93, pp. 393-460 (pelage changes).
MacLulick, 1937: Univ. Toronto Studies, Biol. Ser., No. 43 (fluctuations).
Nelson, 1909: No. Amer. Fauna, No. 29 (revision).
Soper, 1921: Jour. Mammal., vol. 2, p. 102 (notes on abundance, Alberta).

White-tailed Jack Rabbit. *Lepus townsendi* Bachman

Diagnosis. Total length 605 mm. (25·9 in.); tail 92 mm. (3·6 in.) hind foot 149 mm. (5·8 in.); ear from notch 95·6 mm. (3·7 in.) (averages, Nelson); size large; body heavy; legs and ears long; colour, in winter white, with black tips to the ears; in summer yellowish or greyish brown above; tips of ears black; tail, above and below, white; underparts of body white.

The large size, long ears, and in summer the pale colour and the white upper side of the tail are distinctive characters to separate this species from its nearest relatives.

Geographical Variation. This species reaches its northern limits on the plains of the Prairie Provinces, where only one subspecies, to which the above diagnosis applies, occurs. It is:

(1) *Lepus townsendi campanius* Hollister.

Distribution in Alberta. The prairies of the central and southern parts of the province, north to about Edmonton.

Life History. Active throughout year; nocturnal and crepuscular; young 4 to 6 in a litter (Bailey); well developed at birth; food chiefly herbaceous plants and in winter twigs of shrubs; also feed on growing crops and haystacks.

General. During the day the jack rabbit sleeps in the shelter of some bush or tuft of grass or hollow. Startled, it goes bounding away over the plains as conspicuous as an antelope. Single bounds may cover as much as 17 feet 10 inches (Bailey). Then it stops; the ears go down; and the animal sinks flat and one wonders how such a conspicuous animal has so completely disappeared on the flat, open prairie.

In winter, in southern Alberta, they are said to come into alfalfa stubble to feed, and to come about feed stacks. Mr. H. Hargrave says that he has seen as many as 100 about a feed stack at night. In the winter of 1944-45 good winter pelts of jack rabbits were said to bring the few ranch hands who were gathering them about 65 cents apiece.

Reference

Nelson, 1909: No. Amer. Fauna, No. 29 (revision, under name *L. campestris*).

Cottontail Rabbit. *Sylvilagus nuttallii* Bachman

Diagnosis. Total length 385 mm; tail 46; hind foot 95·4; ear from notch 55·8 (averages, Nelson); colour above grizzled greyish brown; nape more rufous; and rump more greyish; top of tail brownish; throat brownish; rest of underparts white.

Geographical Variation. Southern Alberta is the northern limit of the range of this species, and the subspecies is: *Sylvilagus nuttallii grangeri* Allen.

Distribution in Alberta. The extreme south, north at least to Cypress Hills and Nemiskam (Soper).

Life History. Nocturnal and crepuscular; active throughout the year; young 4 to 6 in a litter; undeveloped and naked at birth (Bailey); food herbaceous material and bark and twigs.

General. The bushlands and the broken ground around the edges of coulées in the arid southeast part of the province is the home of the cottontail. At dusk the cottontail emerges from the crevices and holes in the dry mud banks, or from among the rocks, and forages over the short grass plains among the cactus. In places the ground is littered with their droppings. But they do not venture far from their shelters, and at the first alarm they dash back to sit at the mouth of their burrows, and a further alarm sends them inside to safety.

Their habitat overlaps that of the snowshoe rabbit in the brush of the edge of the Cypress Hills; and it overlaps that of the jack rabbit along the edges of the coulées in the plains, but it utilizes underground shelter in a manner that neither of the others does.

References

Bailey, 1936: No. Amer. Fauna, No. 55 (habits of the species in Oregon).

Nelson, 1909: No. Amer. Fauna, No. 29 (revision).

ORDER—ARTIODACTYLA. CLOVEN-HOOFED ANIMALS

This order of cloven-hoofed animals includes the deer and cattle-like animals, and also such exotic groups as swine, hippopotamuses, camels, and giraffes.

Three families are represented in Canada, all of which occur in Alberta: the deer family, the pronghorn family, and the cattle family.

SYNOPSIS OF FAMILIES OF ARTIODACTYLA IN ALBERTA

(Based on species occurring in province)

Family 1—*Cervidae*. Deer and their relatives. Size, medium to large (for the family); height at shoulder over 30 inches (750 mm.); the males, and the females in some species, with deciduous, branched, solid antlers; feet with lateral hoofs as well as main pair; canine teeth present or absent (p. 202).

Family 2—*Antilocapra*. Pronghorn antelope. Size medium (for the order, height at shoulder 30-36 inches (750-904 mm.)); males (and often females) with branched deciduous horn sheaths and an unbranched permanent horn core; only the main pair of hoofs, without lateral rudimentary hoofs, on each foot; canine teeth absent (p. 213).

Family 3—*Bovidae*. Cattle, sheep, and their relatives. Size, medium to large (height at shoulder over 35 inches (877 mm.)); males and females with unbranched permanent horn sheaths on permanent horn cores; cloven hoofs with auxiliary, lateral hoofs; canine teeth absent (p. 216).

FAMILY—CERVIDAE. DEER, ETC.

The deer family is widely spread over Europe, Asia, the Americas, and North Africa. Some of our species have very similar representative species in the Old World: the moose of North America is very similar to the Old World elk; our wapiti or elk is very similar to the Old World red deer; and our caribou are very similar to the Old World reindeer. It is well to call attention here to the confusion

in the use of the word elk; in the Old World it is applied to a moose-like animal, whereas in the New World it is applied to the wapiti, a red deer-like animal. Our white-tailed deer and mule deer are American only.

Figure 87. Some big game mammals: (*a*) white-tailed deer; (*b*) moose (*c*) mule deer; (*d*) caribou; (*e*) bighorn sheep; (*f*) elk; (*g*) buffalo; (*h*) Rocky Mountain goat.

The deer are distinguished by the peculiar character of their antlers. With the exception of a few Old World species, the males have antlers, and these are solid and are shed completely and renewed annually. When growing

the antlers are covered with a layer of modified skin that is rich in blood and easily injured. This is called "velvet" and antlers still covered with it are called "in the velvet". When the antlers are full grown this "velvet" is stripped off by the animals rubbing the antlers against bushes and tree trunks, exposing the solid core. As already mentioned, there are a few, aberrant Old World deer without antlers, and in the caribou-reindeer group the females of some species have antlers (though much smaller than those of the male) and some do not.

The antlers are evidently connected with breeding, and not primarily with protection against enemies, judging by the period during which they are serviceable, that is, during the rut or breeding season, after which they are shed.

The young of the deer are born in a well developed condition and are active soon after birth. The young of many species have a spotted first pelage, a character that some deer (in the Old World) retain throughout life.

The members of this family have not been extensively domesticated, but in northern Eurasia the reindeer is an important domestic animal, and an attempt is being made to introduce the animal and the culture of herding it into our Arctic. As a supplier of meat and the material for buckskin clothing to wilderness dwellers in Canada, two members of this family, the caribou and the moose, are very important. Our species also rank high as big game. Locally certain species may cause damage to crops and to haystacks.

Seven species of this family occur in Alberta.

KEY TO ALBERTA SPECIES OF DEER

(A—Based on antlers)

(1) Antlers with palmations 2

(1a) Antlers without palmations 3

(2) One large, main, central palm from which most of the points rise—moose (*Alces americana*)

(2a) Antlers widely branching, with small palmations near tips of some of the branches—caribou (*Rangifer*) (*See* page 210 for comparison of the species)

(3) Main beam sweeping upward and backward—elk (*Cervus canadensis*)

(3a) Main beam sweeping upward and forward 4

(4) Main beam with unbranched erect spikes—white-tailed deer (*Odocoileus virginianus*)

(4a) Main beam with upright spikes, one of which is forked—mule deer (*Odocoileus hemionus*)

(B—Based on general appearance)

(1) Shoulders higher than hips; muzzle inflated; colour blackish, legs and head paler; size large (adult 6 ft. (1·8 metres) at shoulder) (*Alces americanus*)

(1a) Shoulders not higher than hips; muzzle not inflated; size variable, 5 ft. (1·5 metres) or less at shoulder..... 2

(2) Neck dark brown, body pale brown—(*Cervus canadensis*)

(2a) Neck not darker than body 3

(3) Colour blackish brown to whitish; neck whitish, or with whitish ventral fringe; whitish band on feet above hoofs; neck with dewlap—(*Rangifer*) (*See* page 210 for comparison of species)

(3a) Colour greyish brown or yellowish brown 4

(4) Tail dark above, white below, often carried erect; tail wide and plumelike—(*Odocoileus virginianus*)

(4a) Tail white with black tip; rarely carried erect; tail cylindrical, not wide and plumelike—(*Odocoileus virginianus*)

Elk. *Cervus canadensis* Erxleben

(Also called Wapiti)

Diagnosis. Total length 7 to 9 feet (2·1-2·7 metres); tail 2 to 3 inches (50-76 mm.); height at shoulder about 5 feet (1·5 metres); male only with antlers. The antlers have typically a main, backward sweeping beam ending in a point, and five main prongs rising from it (Figure 87); younger males have smaller antlers with fewer prongs; antlers shed in the winter and renewed in the spring and summer; an upper canine tooth present in both male and female; colour, sides of body yellowish brown, rump patch lighter; head, neck, underparts, and legs, much darker brownish; young calves are spotted.

The bull elk with his characteristic spread of antlers is unmistakable; the size of the animal, the pale-coloured body with the dark head and neck are also distinctive.

Geographical Variation. The subspecies that occurs in Alberta is: *Cervus canadensis nelsoni* Bailey.

Distribution in Alberta. Very common in the foothills and the Rocky Mountains of the west; occasionally seen in the Cypress Hills area (spreading from a Saskatchewan introduction); and a number under fence in the Elk Island National Park.

Life History. Mates in the autumn; 1 or sometimes 2 young born in the spring; food, twigs, seeds, grasses, herbs, bark, leaves, and other plants.

General. The elk is an animal of the open forests and glades. The bugling or whistling of the bull elk in the early autumn is the signal that the males are coming down from the higher altitudes to join the bands of females in the valley bottoms, and that the rut is starting. Each male rounds up, and attempts to hold, a band of females. Savage fights occur between the males, and sometimes one of the combatants is killed.

The bands of elk spend the day in the shelter of the forests of aspen or pine, and at dusk come out into clearings to feed. Driving along parts of the Banff-Jasper highway in the autumn it is possible to see scores of them in the evening or the early morning.

The bull elk is a magnificent game animal that has an open season on it in parts of Alberta. It is the New World representative of the red deer of Europe.

The elk has increased tremendously under protection and in places causes the ranchers concern by its ravages on haystacks. In the winter whole bands come to some such stacks, and the amount of hay they eat and damage is considerable.

References

Anderson, 1938: Trans. Third North American Wildlife Conference, pp. 390-406 (status in Canada).

Green, 1933: Can. Field-Nat., 47, pp. 105-111, 122-132, 150-157, and 172-174 (life history, Manitoba).

White-tailed Deer. *Odocoileus virginianus* Boddaert

(Also called Virginia Deer and Long-tailed Deer)

Diagnosis. Total length 1,803 mm. (70·8 in.); tail 330 mm. (12·9 in.); hind foot 508 mm. (19·9 in.); weight 190 pounds (adult male, North Dakota, Goldman and Kellogg for *O. v. dacotensis*); male with deciduous antlers that have a main beam sweeping upward and forward from which rise erect tines (Figure 87); metatarsal glands on hind legs are small and low down; colour generally greyish brown or reddish brown, upper side of plume-like tail the same; under part of body, and under side of tail white. The young (fawns) are spotted.

The unbranched upright tines of the antlers; the shape and colour of the tail; and the size and position of the metatarsal glands are distinctive.

Geographical Variation. Anderson refers the white-tailed deer from southern Alberta to *Odocoileus virginianus dacotensis* Goldman and Kellogg, but says that lack of specimens from southwest Alberta, from Waterton to Jasper, do not permit definite allocation of the populations in that area, and they may be referable to the western race *Odocoileus virginianus ochrourus* Bailey.

Life History. Antlers shed in winter, and grown again in the spring and early summer; mate in the autumn; usually 2 young born in the spring; gestation period 154 to 168 days (Kenneth); food, twigs, leaves, grass, and herbs.

General. When the alarmed white-tailed deer goes bounding away, its tail usually stands straight up, and it is a great snowy banner that leaves no doubt of identity. It is generally uncommon and local in Alberta, but in the conifer and aspen forests on the Cypress Hills Mr. Dexter Champion estimates there may be four or five hundred deer, half of which are probably this species. They are also present in the dry shrubbery along the coulées some distance from any forest.

In winter, in the Cypress Hills, they gather into bands that usually keep separate from the mule deer. Sometimes a band of as many as 75 white-tailed deer is seen feeding at some haystack, according to Mr. Champion.

References

Bailey, 1933: Nature Mag., 21, pp. 123-126 (general).

Cowan, 1936: Calif. Fish and Game, 22, pp. 156-246 (distribution and taxonomy, with long bibliography).

Mule Deer. *Odocoileus hemionus* Rafinesque

(Also called Black-tailed Deer; Jumping Deer; Jumper)

Diagnosis. Total length 1,755 mm. (69 in.); tail 152 mm. (5·9 in.); hind foot 555 mm. (21·8 in.); ear from crown 235 mm. (9·2 in.); weight 174 to 456 pounds; males with deciduous antlers of which the main beam sweeps upward and forward, with upward pointing tines, one of which characteristically forks again, giving a double fork; a record head from Alberta has a length of outer curve of right antler of 30 inches, and a spread of 39 inches (Ely *et al.*); females normally do not have antlers; ears very large; tail short and cylindrical; metatarsal gland high up on hind leg; colour generally brownish or yellowish grey; forehead dark brownish; some whitish about muzzle and on throat; chest blackish; white rump patch; tail with a black tip (Figure 87).

The double branching of the upright tines of the antlers; the shape and colour of the tail; and the size and position of the metatarsal gland will distinguish the species from the white-tailed deer.

Geographical Variation. A number of subspecies are recognized of this western North American species, of which one (to which the above diagnosis applies) occurs in Alberta as follows: *Odocoileus hemionus hemionus* Rafinesque.

Distribution in Alberta. Widespread, from Milk River to Wood Buffalo Park, most common in the mountains of the west.

Life History. Mates in the autumn, with 2 young born in the spring; food, twigs of bushes and trees, grasses, herbs, and leaves.

General. The mule deer rarely raises its tail as it bounds away, and when it does, the tail appears as a little, black-tipped stub, very different from the snowy,

plume-like tail of the white-tailed deer. When going at full speed the deer travels with a peculiar bounding gait that has given to it the name of "jumper".

Many of the deer that live in the mountains go to higher altitudes in the summer, though a few are to be found at low elevations all summer. In winter they all come down into the lower valleys and gather into large bands. In protected areas they become very tame.

It is said that the mule deer that is now found to the northern borders of the province and beyond, has spread there from the south only in the early part of the present century.

The mule deer is a game animal of some importance. In parts of the province it causes annoyance to some ranchers, and gives pleasure to others, from its habit of gathering about haystacks and feeding on them in winter.

References

Cowan, 1936: California Fish and Game, vol. 22, pp. 155-246 (taxonomy, distribution, and long bibliography).

Soper, 1942: Jour. Mammal., 23, p. 141 (invasion into Wood Buffalo Park).

Moose. *Alces americana* Clinton

Diagnosis. Male about 9 to 10 feet (2·7-3 metres) long; tail, 2 to 3 inches (50-76 mm.); height at shoulders about 6 feet (1·6 metres); female somewhat smaller; male with deciduous antlers (usually none in females); antlers spreading outwards, upwards, and backwards, with a broad, flat palm bearing points along its outer and forward margin; the largest trophy of the Canada moose listed in "North American Big Game" came from Peace River, Alberta. It had a spread of 73 inches; the right palmation measured $37\frac{1}{4}$ by $12\frac{1}{4}$ inches; fourteen points were on the right antler and fifteen on the left; a pendant "bell" of skin on throat, very variable as to size; muzzle broad and inflated; shoulders higher than hips.

The coloration is generally blackish, with pale legs and head; young (calf) reddish brown, not spotted.

Geographical Variation. Three subspecies are recognized in North America, and the Alberta mammals are referable to *Alces americana americana* Clinton.

Distribution in Alberta. The coniferous forests of the north, the west, and the southwest.

Life History. Antlers shed in the winter and grown again in the spring and summer; mate in the autumn; 1, sometimes 2, young born in the spring; food largely browse (leaves and twigs), with some grasses and herbs, and some aquatic plants.

General. The moose is an animal of the coniferous forests, where it usually lives in solitude. At dusk and at early morning it can be seen out in the meadows, swamps, and bogs of the valley bottoms browsing on the twigs and leaves of the willows and dwarf bushes, or in the summer it may be standing nearby submerged in some lake, at intervals plunging its head under water to gather the aquatic herbage that constitutes part of its diet.

The animal is important to the wilderness dwellers, as well as being an important game animal.

Reference

Merrill, 1916: The Moose Book, Dutton & Co.

Barren-ground Caribou. *Rangifer arcticus* Richardson

(Usually called "Deer" in the north)

Diagnosis. Total length up to about 6½ feet (1·9 metres); tail about 6 inches (152 mm.); height at shoulder about 46 inches (1·1 metres); weight with entrails removed, 90-130 pounds (males, Richardson); male with large, female with small, antlers; antlers with slender beam, round in cross-section, with small palmations. The antlers consist of a main beam that sweeps backward, outward, and then forward; brow tines (one often aborted) projecting over the face; a pair of forward projecting bez-tines above the brow tines; colour in summer, clove-brown, mingled with deep reddish and yellowish browns; the under surface of neck and the belly white; in late winter becomes dirty white by wear and fading (Richardson); neck and rump patch whitish, band of white on foot above hoof.

The characters that separate the three caribou in Alberta are not well worked out. In general the barren-ground caribou is a pale-coloured, small animal with (in

the male) long slender antlers (females usually with small antlers), and migrates southward from the barrens in some winters into northern Alberta; the western woodland caribou is a larger, darker animal with (in the male) shorter, heavier, and more palmate antlers (females often lacking antlers), and is a resident in northern Alberta; the mountain caribou is still larger and darker, with straight heavy antlers in the male; female usually without antlers; resident of the Rocky Mountains.

Geographical Variation. The form that occurs in Alberta is:

(1) *Rangifer arcticus arcticus* Richardson, to which the above diagnosis applies.

Distribution in Alberta. Occasionally comes southward from the barrens into Wood Buffalo Park in winter.

Life History. Migrate southward in winter; mate in the autumn; usually 1 young born in the spring; food, lichens, grasses, herbs, and browse.

General. The usual summer home of the barren-ground caribou is farther north than Alberta, on the barren grounds of the Northwest Territories. In late autumn and early winter they begin to wander southward in immense bands. That this movement is true migration has been questioned as the herds are said to wander irregularly and the course taken by them is not necessarily the same each year. They used to come as far south in Alberta as Fort McMurray some years, but in recent years they are recorded only in the extreme northeast corner of Wood Buffalo Park where Soper reports they prefer rugged rock and moss country with sparse timber and many openings.

References

Soper, 1942: Jour. Mammal., 23, p. 143 (occurrence, Alberta).
Preble, 1908: No. Amer. Fauna, No. 27 (occurrence in Alberta).

Woodland Caribou. *Rangifer caribou* Gmelin

Diagnosis. Male, total length of skull 417 mm. (16·4 in.); greatest orbital breadth 163 mm. (16·2 in.) (western form, Hollister); a darker, larger animal than the barren-

ground caribou; but with antlers shorter, less sweeping, and the beams tending to be flat in cross-section rather than round, and with heavier palmations; females occasionally have small antlers; colour of body dark brown; neck whitish; band just above hoofs and area on buttocks white; tail dark.

Geographical Variation. The Alberta form is: (1) *Rangifer caribou sylvestris* Richardson.

Distribution in Alberta. The northern part of the province.

Life History. Probably mate in the autumn and 1 young born in the spring; food, lichens, grasses, herbs, and some browse.

General. Soper writes that the woodland caribou formerly ranged throughout Wood Buffalo Park, but by 1934 they were very scarce or entirely absent from the eastern and southern part. Though this species is usually considered non-migratory, Soper writes that in this area there is a westward withdrawal for the summer to the Caribou Mountains Highlands, and a spreading out over the adjacent forested plains after the freeze-up.

Reference

Soper, 1942: Jour. Mammal., 23, p. 142 (occurrence, Alberta).

Mountain Caribou. *Rangifer fortidens* Hollister

Diagnosis. Total length 2,370 mm. (90·2 in.); tail 150 mm. (5·9 in.); hind foot 690 mm. (27·1 in.) (adult male). Male with large, stout antlers; main ascending beam rather straight, without the low, sweeping, backward curve of the barren-ground caribou; less slender and more palmate; apparently the females are normally without antlers. Colour of type: head blackish brown; neck greyish brown with a small white throat mane; body brownish black; legs brownish black, feet broadly white above hoofs; rump patch small, white; tail like back above, bordered with white; July adult in old pelage (above largely from Hollister).

This is apparently the largest and darkest of our caribou.

Geographical Variation. This form is probably closely related to *R. montanus* of British Columbia. Anderson includes them in the species *R. arcticus* (the barren-ground caribou), but it is very probable that they are closely related to *R. caribou* (the woodland caribou). For the present it seems advisable to keep them as separate species.

Distribution in Alberta. Timberline conditions in the Jasper area, occasionally south to near Banff.

General. This is an alpine species whose home is in the Rocky Mountains where stunted fir trees give way to grassland.

FAMILY—ANTILOCAPRIDAE. PRONGHORNS

This family has only a single surviving member, the pronghorn antelope of western North America. In earlier geological times, in the Miocene, Pliocene, and Pleistocene, this family was represented by a host of species, all in North America. It can be considered truly American for no fossil ancestors have been found outside the western hemisphere (Scott).

The pronghorn occupies a very isolated zoological position, and the distinctiveness is most easily seen in the character of the horns. They consist of a bony, unbranched horn core, and a branched, deciduous horn sheath that is shed and renewed annually. The new horn is well formed beneath the old horn before shedding occurs, so that the animal is never completely hornless. In this they stand part way between the horned animals, in which the horn sheath is unbranched and persistent, and the deer, in which the antler is forked and shed, but is solid without any horn core; however, they are more closely related to the Bovidae (ox family) than the Cervidae (deer family) in skeletal characters.

The pronghorn is a prairie animal adapted for speed, and the foot is so far modified by evolution for this that the dew claws have disappeared.

The young, usually 2 in number, are born in an advanced condition, active soon after birth, and able to follow their parents.

Pronghorn Antelope. *Antilocapra americana* Ord

(Also called Antelope, American Antelope, Pronghorn)

Diagnosis. Height at shoulder about 30 to 36 inches (750-902 mm.); form very trim and slender, with smooth coat; males with conspicuous horns with one branch (females with very small horns); the record head for Alberta has a length of $17\frac{5}{8}$ inches measured along the outside curve of the right horn, and a greatest spread of horns of $13\frac{3}{4}$ inches and a tip to tip measurement of $7\frac{1}{2}$ inches (Ely *et al.*); colour generally tawny brown above; white below, with a pattern of tawny white bars on the throat; the white extending far up the flanks, and a conspicuous white rump patch; on the muzzle, side of the head, and the top of the neck is some dark brown.

The young are not spotted.

Geographical Variation. The subspecies in Alberta is: *Antilocapra americana americana* Ord.

Distribution in Alberta. The southern plains, formerly north to about North Saskatchewan River; now to somewhat north of South Saskatchewan River.

Life History. An animal of the plains; makes local migrations; mates in late autumn or early winter; 2 young, usually, born the following spring; food chiefly grasses and herbs.

General. The pronghorn antelope is an animal of the open plains. In spring and summer they wander about singly or in small groups, in the autumn, with the first snow they gather together in bands and some of them undertake short migrations to favourite wintering places. The Suffield area and the Wildhorse area are two notable wintering areas, where thousands of antelope may be seen in a day in the winter.

The antelope is probably our fleetest animal afoot. People who drive the prairie roads say that they have commonly paced it by automobile at 45 miles an hour. Strangely the antelope does not always flee from an approaching car, it may race alongside it, or gallop on a converging route, and then cross in front of the automobile. After going some distance at top speed, it may stop and turn around to watch the intruder.

Often, as one is crossing the plains, the first intimation one has of the antelope is the flashing of their conspicuous white rump patches. Open, unfenced country is the antelope's home, where its mammalian neighbours are the badger, prairie ground squirrels, and coyotes. But it has learned to pass fences, not by jumping them but by crawling through them. An antelope at full speed seems to hardly pause when it comes to an ordinary three-strand barbed wire fence, but seems to slide through and continue with hardly a check.

Figure 88. Pronghorn antelope.

In the early days antelope were probably as abundant as the buffalo. They were said to cover the prairie like bands of sheep, and to migrate in immense bands, that were followed by Indian hunters who were living on them.

The antelope was almost exterminated in Canada by the hard winter of 1906. Its recovery was very slow; by 1924 Nelson estimated only 1,030 antelope in Alberta and 297 antelope in Saskatchewan. Since the 1930s the increase has been steady, and in 1945 a survey by the National Museum of Canada showed that there were probably more than 30,000 antelope in the two prairie provinces. A moderate amount of hunting has been possible for some years, and the future of our antelope is bright, unless, or until, another hard winter strikes and wipes them out again.

References

Nelson, 1924: U.S. Dept. Agric., Bull. No. 1346, 64 pp. (status).
Rand, 1946: Nat. Mus., Canada, Bull. 106 (status in Canada).

FAMILY—BOVIDAE

Used in a broad sense this family includes cattle, bison, sheep, goats, mountain goats, chamois, gazelles, antelope, and many other cloven-hoofed animals that are sometimes put into separate families. Used in this broad sense it is a very large family, and its members are probably more numerous than all other hoofed animals.

The centre of abundance is in the Old World, with a few species in the northern part of North America.

They are herbivorous animals; the young are born in an advanced stage of development, and able to follow the parent soon after birth.

Many species are important to man. The family has supplied our domestic cattle and sheep, yielding food (meat, milk, butter, and cheese) and clothing (woollen cloth and shoe leather); wild forms in Canada are generally less important than the deer family for food and clothing to wilderness dwellers at the present time, though the bison was formerly important to various tribes of plains Indians and the sheep is used to a certain extent. The bighorn sheep and the Rocky Mountain goat are important as game animals. For an account of hunting these animals *See* Ely *et al.*, 1939, North American Big Game, Charles Scribner's Sons, New York.

Three species occur in Alberta.

KEY TO ALBERTA BOVIDAE

(1) Pelage entirely white—Rocky Mountain goat (*Oreamnos americanus*)

(1a) Pelage not white 2

(2) Colour generally brownish or brownish black—bison (*Bison bison*)

(2a) Colour greyish brown, with conspicuous rump patch—Rocky Mountain big horn sheep (*Ovis canadensis*)

Bison. *Bison bison* Linnaeus

(Also called Buffalo)

Diagnosis. Bulls, total length 10-12½ feet (3,042-3,803 mm.); tail 20-36 inches (507-913 mm.); hind foot 23-26 inches (584-661 mm.); height at shoulder 5½-6 feet (1,673-1,825 mm.); cows somewhat smaller (Seton); average weight of full-grown bull about 1,800 pounds (Soper); largest Alberta trophy has a length of outside curve of right horn of 19¼ inches, with circumference at base of 13¾ inches (Ely *et al.*); females much smaller. Horns rising sideways and upwards, and curving inwards in old animals; old males especially with shoulders much higher than the smaller hips; head carried low; pelage on head, neck, and shoulders very much longer than on rest of body; tail with a tuft of long hair at tip; colour generally dark brown to blackish brown; calves light yellowish or reddish brown.

Geographical Variation. Originally two subspecies occurred in Alberta. The plains bison, *Bison bison bison*, and a larger, darker subspecies with more slender, more incurving horns (Allen) *Bison bison athabascae* Rhoads. The only bison at large in Alberta are in Wood Buffalo Park and represent a small remnant of the original wood bison, with a much larger admixture of the imported plains bison.

Distribution in Alberta. At large only in Wood Buffalo Park; several hundred are under fence in Elk Island Park.

Life History. Breed in late summer or early autumn; 1 young born the following spring; food largely grasses and sedges (Soper).

General. Up until the final third of the last century bison were present in large numbers on our plains. By 1900 there were only two herds of bison in a wild state in the world; one in Yellowstone Park, and one in Wood Buffalo Park. A large protected herd of plains bison was kept at Wainwright. It was started in 1907 and 1909 with animals purchased from Don Michel Pablo of Montana, consisting of 709 head. By 1920 there were about 5,000 animals on this 160 square mile, fenced park (Hewitt). In Wood Buffalo Park in 1922 there were about 1,500 to 2,000 wood bison (Soper). In the 4-year period beginning in 1925, 6,673 plains bison from the Wainwright herd were shipped to Wood Buffalo Park. In 1934 Soper estimated there were about 12,000 head of bison in this latter preserve, and in 1945 about 20,000 animals.

At the present time, in Elk Island Park, within 30 miles of Edmonton it is possible to see herds of bison living in a semi-wild state on the enclosed range of mixed aspen and meadows.

As set forth under the heading "Geographical Variation", the wood bison is a large, darker, northern representative of the plains bison; a different subspecies.

There is an European animal, the European bison or wisent, that is the Old World representative of our bison, and is very similar to it. It is on the verge of extermination.

References

Allen, 1876: The American bison, living and extinct; Mem. Mus. Comp. Zool., vol. 4, IX+246 pp.

Allen, 1877: 9th Report U.S. Geol. and Geogr. Survey Terr., pp. 444-587 (history of bison).

Hewitt, 1921: The Conservation of the Wildlife in Canada, New York.

Hornaday, 1889: Ann. Rept. U.S. Nat. Mus. for 1887, pp. 367-548 (discovery, life history, and extermination).

Soper, 1941: Ecol. Monographs, 11, pp. 349-412 (history, range, and home life of the northern bison).

Rocky Mountain Bighorn Sheep. *Ovis canadensis* Shaw
(Also called Bighorn; Rocky Mountain Big Horn; Bighorn Sheep; Rocky Mountain Sheep)

Diagnosis. Male, total length 1,600 mm. (62·9 in.); tail 100 mm. (3·9 in.); hind foot 440 mm. (17·3 in.); ear from notch 100 mm. (3·9 in.) (Alberta male, Cowan); weight, males 285-344 pounds (Cowan). The record Alberta head, with a length of front curve of right horn of 46¾ inches and a circumference at base of 15½ inches and greatest spread of 23 inches, is the second largest trophy listed (Ely *et al.*); female much smaller; body stout; legs slender; coat close and smooth. Males with very large, massive, curled horns that sweep upwards and backwards, and then curl around until the point comes in front of the eye. This point is usually kept broken off by the animal. Female with much smaller, more slender horns, that sweep upwards and backwards.

Colour generally greyish brown, with large, conspicuous, whitish rump patch surrounding the dark brown tail.

Geographical Variation. Cowan in his excellent monograph shows that all the mountain sheep in North America are referable to two species, the northern thin-horned sheep of Alaska, Yukon, and north British Columbia; and the present species embraces all the many forms south of that. The Alberta form is *Ovis canadensis canadensis* Shaw.

Distribution in Alberta. Common in the Rocky Mountains.

Life History. Diurnal; mate in the autumn; 1 young born the following spring after a gestation period of 180 days (Spencer); food, grasses, sedges, herbs, and some browse.

General. The sheep is a grazing animal of the mountain slopes. As with many mountain animals, the bighorn in Alberta has a seasonal, altitudinal migration. In summer they feed high up near timberline, though even then they may come down to salt-licks in the valley bottoms.

Just north of Banff, on the Banff-Jasper highway, is one such place where sheep may be seen all summer along the road. In autumn, winter, and spring most of the sheep come down low into the valleys.

The sheep are promiscuous in their breeding habits. Old males fight fiercely amongst themselves. They face each other, from 10 to 40 feet apart, then dash at each other, head-on, meeting with a resounding crash.

Closely related species of mountain sheep live in Asia.

References

Cowan, 1940: Amer. Midl. Nat., 24, pp. 505-580 (taxonomic monograph).
Spencer, 1943: Jour. of Mammal., 24, pp. 1-11 (life history, Colorado).

Rocky Mountain Goat. *Oreamnos americanus* Blainville

Diagnosis. Total length 57-66 in. (1,425-1,650 mm.); tail 6-8 in. (150-200 mm.); height at shoulder 36-43 in. (900-1,075 mm.) (Grant); weight 150-300, and even 400, pounds (Grant); male and female with sharp, slender black horns that rise upward and slightly backward; record head for Alberta has the front curve of right horn $10\frac{3}{4}$ inches (Ely *et al.*); legs short, shape bulky, shoulders high, fur shaggy, extending part way down the legs; males with "beard"; colour white, with black horns, and muzzle patch.

The shape, the colour, and the slender spike horns are distinctive.

Geographical Variation. The subspecies found in Alberta is *Oreamnos americanus americanus* Blainville.

Distribution in Alberta. The Rocky Mountains.

Life History. Breeds in the autumn; 1 or 2 young born in the spring; gestation period 147 days (Kenneth); food, herbs, twigs, and some grasses (Grant).

General. The Rocky Mountain goat's favourite habitat includes the roughest, most broken, rocky terrain in the mountains. And here on great cliffs it prowls about sure-footedly on narrow ledges and steep faces that makes a human beholder wonder how the goat can possibly find

his way. The goat does not skip about from ledge to ledge, but it slowly and carefully walks and crawls, looking carefully about before making a move, always moving cautiously, and in difficult places sometimes having to make detours and even to retrace his steps.

He is a clumsy-looking, slow-moving, powerful animal, without the quick agility of the mountain sheep, and never ventures far from the broken rocky fastnesses where he can easily out-distance his enemies.

Sometimes, as though tired of such rugged rocks, the goats move out onto nearby meadows or grassy and brushy benches to feed and lie down.

It is sometimes alleged that goats and sheep have an antipathy toward each other, and where you find one you will not find the other. It is true that goats and sheep prefer different habitats, and consequently are not usually found together, but this is a question of habitat selection not mutual antipathy, and they sometimes occur on the same mountains.

Vernacular names often do not express relationships well, and that is the case with this animal. It is a member of the family Bovidae, that includes the sheep, goats, cattle, antelope, etc., but its nearest relatives are a number of Old World animals that are sometimes called mountain antelope, and include such animals as the chamois of Europe and Asia, and the goral and serow of Asia.

Reference

Grant, 1905: Ninth Ann. Report New York Zool. Soc., 1904 (general).

REFERENCES

Below are listed some of the many important publications dealing with mammals; although some are out of print they may be available in local libraries.

Extinct and Vanishing Mammals of the Western Hemisphere, with the Marine species of all the Oceans, by G. M. Allen; 620 pages. American Committee for International Wild life Protection, Special Publication No. 11, 1942. Contains a wealth of detail on the distribution and decrease of many species.

Catalogue of Canadian Recent Mammals, by R. M. Anderson; 238 pages. National Museum of Canada, Bull. No. 102, 1946. A list of the species and their distribution.

Field book of North American Mammals, by H. E. Anthony; 625 pages. G. P. Putman's Sons, New York-London, 1928. Illustrated, descriptions, ranges, and habits.

Mammalia, by F. E. Beddard; 605 pages. Macmillan and Company, 1902. A general survey of mammals of the world. One of the Cambridge Natural History series.

North American Big Game, by Alfred Ely *et al.;* 533 pages. Charles Scribner's Sons, 1939. Illustrated; descriptions, habits, etc., and chapters on hunting by various authors; tables of record trophies and their measurements.

An Introduction to the Study of Mammals, Living and Extinct, by W. H. Flower and Richard Lydekker; 763 pages. Adam and Charles Black, 1891. Though old, this is still an extremely useful text book.

American Mammals—Their Lives, Habits and Economic Relations, by W. J. Hamilton, Jr.; 434 pages. McGraw-Hill Book Company Inc., 1939. A survey for students, with many references.

Economic Mammalogy, by Junius Henderson and Elberta L. Craig; 397 pages. Charles C. Thomas, 1932. Discusses the value of other mammals to man from many viewpoints, with numerous references.

The Conservation of the Wild Life of Canada, by C. Gordon Hewitt; 344 pages. Charles Scribner's Sons, 1921. Contains much interesting mammal data.

Wild Animals of North America. Intimate studies of big and little creatures of the Mammal Kingdom, by E. W. Nelson. Natural-colour portraits by Louis Agassiz Fuertes. Track sketches by Ernest Thompson Seton; 254 pages. National Geographic Society, Washington, 1930. Accounts and colour pictures of many species.

List of North American Recent Mammals, 1923, by G. S. Miller; 673 pages. United States National Museum Bulletin 128, 1924. A list with ranges.

Mammals of America; 335 pages. Nature Lovers Library, University Soc. Inc., 1917. Popular illustrated accounts.

The Age of Mammals, by H. F. Osborn; 635 pages. The Macmillan Company, 1910. Deals with the history of our mammals.

Homes and Habits of Wild Animals, by K. P. Schmidt; 64 pages. M. A. Donohue & Co., 1934. With illustrations in colour; written for children.

A History of Land Mammals in the Western Hemisphere, by W. B. Scott; 786 pages. The Macmillan Company, 1937. A well illustrated text on the palæontological history of our mammals.

Life Histories of Northern Animals, an account of the Mammals of Manitoba, by Ernest Thompson Seton; with 68 maps and 560 drawings by the author; 2 volumes, 1,267 pages. Charles Scribner's Sons, 1909. Contains descriptions, ranges, and lives.

Lives of Game Animals, an account of those land Animals in America, north of the Mexican Border, which are considered "Game" either because they have held the attention of Sportsmen, or received the protection of law, by Ernest Thompson Seton; with 50 maps and 1,500 illustrations by the author; 4 volumes. Doubleday, Doran & Company Inc., 1929. This is a classic for content and style.

American Animals, a popular guide to the Mammals of North America north of Mexico, with intimate biographies of the more familiar species, by Witmer Stone and William Everett Cram; 318 pages. Illustrated. Doubleday, Page & Co., 1905. This is volume 4 of the Nature Library.

Among the previous publications on the Mammals of Alberta the following may be mentioned:

A Biological Investigation of the Athabasca-Mackenzie Region, by E. A. Preble; North American Fauna, No. 27, pp. 574 (1908) (summarizes earlier data).

Mammals of the Alpine Club Expedition to the Mount Robson Region, by N. Hollister; Can. Alpine Journal, Special Number, pp. 146 (1912).

Gleanings from the Canadian West, Part 2, Mammalian Fauna of Islay, Alberta, by J. Dewey Soper; Canadian Field-Nat., vol. 35, pp. 102-111 (1921).

Mammals of the Athabasca and Great Slave Lakes Region, by Francis Harper; Jour. Mammal., vol. 13, pp. 19-36 (1932).

Mammals of Wood Buffalo Park, Northern Alberta and District of Mackenzie, by J. Dewey Soper; Jour. of Mammal., vol. 23, pp. 119-145 (1942).

Notes on some Mammals of the southern Canadian Rocky Mountains, by Peter E. Crowe; Bull. Amer. Mus. Nat. Hist., 80, pp. 391-410 (1943).

Current research on mammals is published in the Journal of Mammalogy now (1946) in its 27th year, and put out quarterly by the American Society of Mammalogists; and the Canadian Field-Naturalist, now in its 60th year, and published by the Ottawa Field Naturalists Club at Ottawa, runs papers on mammals. Both expect to publish articles on the mammals of Alberta shortly.

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Index to Family, Generic, Specific, Subspecific, and English Names

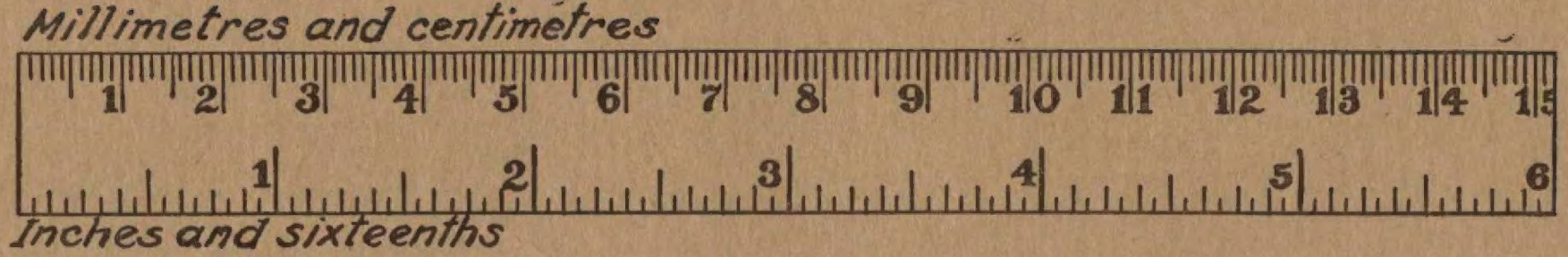

Figure 89. Ruler, comparing metric and English systems of measuring.